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# Stationary Source Testing of a Missouri-Type Charcoal Kiln

Midwest Research Inst, Kansas City, Mo

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This report presents the results of source testing performed in 1975 on a charcoal kiln in Missouri for particulate, total organic, and polycyclic organic material (POM) emissions. The testing was not done for compliance reporting but rather for research into the general amount and types of emissions present during operation of a typical kiln. The data are to be used for the possible establishment of a new source emission standards and for evaluation of potential contro' techniques for the charcoal industry in Missouri.

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# REPORT

EPA-907/9-76-001

## STATIONARY SOURCE TESTING OF A MISSOURI-TYPE CHARCOAL KILN

FINAL REPORT
August 3, 1976

Midwest Research Institute
EPA Contract No. 68-02-1403
MRI Project No. 3927-C(14)

For

Region VII
Environmental Protection Agency
1735 Baltimore
Kansas City, Missouri 64108

Attn: Mr. Charles W. Whitmore

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EPA-907/9-76-001

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by

William H. Maxwell

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## PREFACE

The work reported herein was conducted by Midwest Research Institute (MRI) under Environmental Protection Agency (EPA) Contract No. 6802-1403, Task No. 14.

The project was under the technical supervision of Mr. Paul C. Constant, Jr., Head, Environmental Measurements Section of the Physical Sciences Division. Mr. William Maxwell served as project chief and was assisted by Mr. Bruce DaRos. The analysis of the samples was done by Dr. Clarence Haile, Ms. Carol Green, and Ms. Mary Woodfin under the technical supervision of Dr. Mark Marcus. Mr. Thomas Merrifield was responsible for the data reduction and computer analysis. Some sample analysis was done by Kansas City Testing Laboratories under the direction of Mr. A. G. Cloud, Chief Chemist.

Approved for:

MIDWEST RESEARCH INSTITUTE

Paul C. Constant, Jr.
Program Manager

L. J. Shannon, Assistant Director
Physical Sciences Division

August 3, 1976

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# 1. INTRODUCTION

This report presents the results of source testing performed during the period December 2 to 9, 1975, by MRI on a Missouri-type charcoal kiln at the Wulff Charcoal Company, Vienna, Missouri. Testing for particulate, total organic, and polycyclic organic material (POM) emissions was conducted on each of the eight uncontrolled stacks of the kiln during a burn cycle, a continuous process.

The testing was not done for compliance reporting but rather for research into the general amount and types of emissions present during operation of a typical kiln. These data are to be used for the possible establishment of new source emission standards and for evaluation of potential control techniques for the charcoal industry in Missouri. The testing was also done as a means of developing and evaluating source sampling methodology for charcoal kilns. The scope of work for this project specified:

1. At least one sample per day for particulate, total organic, and POM emissions over the period of a burn cycle.

2. Flammability limits sampling.

3. Visible emission observations.

The following sections of this report present:

1. Summary and discussion of results;

2. Process description and operation;

3. Sampling and analytical procedures; and

4. Recommendations and comments.

## II. SUMMARY AND DISCUSSION OF RESULTS

### A. Mass and Total Organics

Table 1 presents a summary of the particulate results for the eight runs. Data are presented as grains per dry standard cubic foot (gr/dscf), milligrams per normal cubic meter (mg/ncm), pounds per hour (lb/hr), and kilograms per hour (kg/hr). Computer printouts of the field data and reductions may be found in Appendix A. Sample calculations are found in Appendix B.

The runs are broken down into three sections. Run No. 1 was completed during the 3-hr kiln start-up period before the doors were closed and sealed. The resulting values may be considered representative of emissions found during this period. They should only be considered approximate due to the sampling method as will be reported later. Runs Nos. 3, 5, 7, 9, 11, and 14 are complete daily runs conducted each full day of the burn cycle. These data indicate the trend of emissions over the cycle of the burn. Run No. 13 was a partial run covering only one and two-thirds stacks on 1 day. These data may indicate those emissions from a lesser number of stacks but were not used in subsequent emission factor calculations.

Sampling volumes for the six daily runs varied from 16.80 dscf (0.48 ncm) to 93.53 dscf (2.65 ncm). Values for the percent isokinetic sampling rate varied from 94.0 to 104.6.

Table 2 presents a summary of the organic results for the eight runs. These data are based on the ether-chloroform extractable portion of the particulate samples and are presented in the same form as the particulate data. Computer printouts of the field data and reductions are found in Appendix C. The same raw field data and sample calculations as for the particulate runs apply to the organic runs.

The relationship between the total particulate catch and the organic fraction is shown in Table 3. The emission rate from the total mass calculations is compared with that of the organic fractions. The organic fraction of the total mass emissions is in the range of 66 to 77%.

Table 4 presents a summary of the mass emission factors (unit emissions per unit charcoal produced) for each run as well as the total for the burn cycle. These emission factors have been computed by three methods. In the first method, the data for each run are taken to represent that of the 24-hr period encompassing the run time.

TABLE 1

SUMMARY OF PARTICULATE RESULTS

| Run No. | Date | Total particulate load[a] Partial[b] gr/dscf[c] | mg/ncm[c] | lb/hr[c] | kg/hr[c] | Total[b] gr/dscf[c] | mg/ncm[c] | lb/hr[c] | kg/hr[c] |
|---|---|---|---|---|---|---|---|---|---|
| | Start-up | | | | | | | | |
| 1 | December 2, 1975 | 1.09 | 2,487 | 180[d] | 82[d] | 1.32 | 3,022 | 219[d] | 99[d] |
| | Burn-cycle | | | | | | | | |
| 3 | December 3 | 0.36 | 815 | 1.04 | 0.46 | 0.80 | 1,829 | 2.32 | 0.97 |
| 5 | December 4 | 0.76 | 1,734 | 2.16 | 1.05 | 2.21 | 5,054 | 6.24 | 2.83 |
| 7 | December 5 | 2.95 | 6,751 | 6.72 | 3.06 | 17.40 | 39,824 | 39.84 | 18.06 |
| 9 | December 6 | 1.64 | 3,745 | 3.43 | 1.55 | 3.77 | 8,628 | 7.91 | 3.58 |
| 11 | December 7 | 2.43 | 5,553 | 5.44 | 2.46 | 5.21 | 11,917 | 11.68 | 5.29 |
| 14 | December 8 | 6.29 | 14,383 | 9.03 | 4.10 | 9.21 | 21,074 | 13.23 | 6.01 |
| | Other | | | | | | | | |
| 13 | December 8 | 4.20 | 9,602 | 1.57 | 0.71 | 6.82 | 15,618 | 2.56 | 1.16 |

a/ Total for all stacks emitting during test; 8 stacks for Runs Nos. 3, 5, 7, and 11; 7 stacks for Runs Nos. 9 and 14; 1.67 stacks for Run No. 13; 1 stack (nominal) for Run No. 1; grains per dry standard cubic foot and milligrams per normal cubic meter are irrespective of number of stacks.

b/ Partial = Front half of sampling train only (probe, cyclone, first filter)
Total = Entire train

c/ gr/dscf = Grains per dry standard cubic foot
mg/ncm = Milligrams per normal cubic meter
lb/hr = Pounds emissions per hour
kg/hr = Kilograms emissions per hour

d/ Values for Run No. 1 are approximate and based on a nominal 10-ft diameter stack.

TABLE 2

SUMMARY OF ORGANIC RESULTS

| Run No. | Date | Total organic load[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Partial[b] | | | | Total[b] | | | |
| | | gr/dscf[c] | mg/ncm[c] | lb/hr[c] | kg/hr[c] | gr/dscf[c] | mg/ncm[c] | lb/hr[c] | kg/hr[c] |
| | Startup | | | | | | | | |
| 1 | December 2, 1975 | 0.72 | 1,733 | 127[d] | 58[d] | 0.89 | 2,045 | 149[d] | 67[d] |
| | Burncycle | | | | | | | | |
| 3 | December [illegible] | 0.30 | 593 | 0.72 | 0.34 | 0.55 | 1,269 | 1.69 | 0.73 |
| 5 | December [illegible] | 0.69 | 1,372 | 1.68 | 0.79 | 1.62 | 3,718 | 4.56 | 2.08 |
| 7 | December 5 | | | | | 13.3 | 30,782 | 30.80 | 13.95 |
| 9 | December 6 | 1.26 | 2,875 | 2.66 | 1.19 | 2.86 | 6,535 | 6,535 | 1.94 |
| 11 | December 7 | 1.92 | 4,390 | 4.32 | 2.71 | 3.54 | 8,105 | 8,105 | 3.59 |
| 14 | December 8 | 4.59 | 10,300 | 9.44 | 2.94 | 6.38 | 14,608 | 9.17 | 4.17 |
| | Other | | | | | | | | |
| 13 | December 8 | 2.70 | 6,169 | 1.02 | 0.46 | 4.52 | 10,334 | 1.68 | 0.77 |

a/ Total for all stacks emitting during test; 8 stacks for Runs Nos. 3, 5, 7, and 11; 7 stacks for Runs Nos. 9 and 14; 1.67 stacks for Run No. 13; 1 stack (nominal) for Run No. 1; grains per dry standard cubic foot and milligrams per normal cubic meter are irrespective of number of stacks.

b/ Partial = Front half of sampling train only (probe, cyclone, first filter)
Total = Entire train

c/ gr/dscf = Grains per dry standard cubic foot
mg/ncm = Milligrams per normal cubic meter
lb/hr = Pounds emissions per hour
kg/hr = Kilograms emissions per hour

d/ Values for Run No. 1 are approximate and based on a nominal 10-ft diameter stack.

TABLE 3

SUMMARY OF MASS AND ORGANIC DATA

| Run No. | Date | Total mass[a] lb/hr[b] | Total mass[a] kg/hr[b] | Total organic[a] lb/hr[b] | Total organic[a] kg/hr[b] | Percent organic |
|---|---|---|---|---|---|---|
| | Start-up | | | | | |
| 1 | December 2, 1975 | 219[c] | 99[c] | 149[c] | 67[c] | 68 |
| | Burn-cycle | | | | | |
| 3 | December 3 | 2.32 | 0.97 | 1.60 | 0.73 | 69 |
| 5 | December 4 | 6.24 | 2.83 | 4.56 | 2.08 | 73 |
| 7 | December 5 | 39.84 | 18.06 | 30.80 | 13.95 | 77 |
| 9 | December 6 | 7.91 | 3.58 | 5.95 | 1.94 | 75 |
| 11 | December 7 | 11.68 | 5.29 | 7.92 | 3.59 | 68 |
| 14 | December 8 | 13.23 | 6.01 | 9.17 | 4.17 | 69 |
| | Other | | | | | |
| 13 | December 8 | 2.56 | 1.16 | 1.68 | 0.77 | 66 |

a/ Total for all stacks emitting during test; 8 stacks for Runs Nos. 3, 5, 7, and 11; 7 stacks for Runs Nos. 9 and 14; 1.67 stacks for Run No. 13; 1 stack (nominal) for Run No. 1; data are for entire sampling train.

b/ lb/hr = Pounds emissions per hour
kg/hr = Kilograms emissions per hour

c/ Values for Run No. 1 are approximate and based on a nominal 10-ft diameter stack.

TABLE 4

SUMMARY OF MASS EMISSION FACTORS (CHARCOAL PRODUCTION)

| | Method I[a] | | | | | Method II[b] | | | | | Method III[c] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Run No. | Period covered | Total mass emissions lb[d] | Total mass emissions kg[d] | Emission factor lb/ton[d] | Emission factor kg/Mton[d] | Period covered | Total mass emissions lb[d] | Total mass emissions kg[d] | Emission factor lb/ton[d] | Emission factor kg/Mton[d] | Period covered | Total mass emissions lb[d] | Total mass emissions kg[d] | Emission factor lb/ton[d] | Emission factor kg/Mton[d] |
| 1[e] | 12:00-15:00 December 2, 1975 | 636 | [illegible] | [illegible] | 18.[illegible] | | | | | | 12:00-15:00 December 2, 1975 | 636 | [illegible] | 36.3 | 18.[illegible] |
| 3 | 15:00 December 2 – 15:00 December 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 2 – [illegible] December 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 2 – [illegible] December 3 | [illegible] | [illegible] | [illegible] | 1.8 |
| 5 | 15:00 December 3 – 15:00 December 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 3 – [illegible] December 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 3 – [illegible] December 4 | [illegible] | [illegible] | [illegible] | 4.8 |
| 7 | 15:00 December 4 – 15:00 December 5 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 4 – [illegible] December 5 | 1,11[illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 4 – [illegible] December 6 | [illegible] | [illegible] | [illegible] | [illegible] |
| 9 | 15:00 December 5 – 15:00 December 6 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 6 – [illegible] December 7 | [illegible] | [illegible] | 12.1 | 6.1 | [illegible] December 6 – [illegible] December 7 | [illegible] | [illegible] | 1[illegible].1 | 6.[illegible] |
| 11 | 15:00 December 6 – 15:00 December 7 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 7 – [illegible] December 8 | [illegible] | 148 | [illegible] | [illegible] | [illegible] December 7 – [illegible] December 8 | 421 | 191 | 17.8 | 8.9 |
| 13 | 15:00 December 7 – 15:00 December 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] December 8 – [illegible] December 9 | [illegible] | 168 | [illegible] | [illegible] | [illegible] December 8 – [illegible] December 9 | [illegible] | [illegible] | [illegible] | 10.1 |
| Total | [illegible] hr | [illegible] | [illegible] | [illegible] | [illegible] | 168 hr | [illegible] | [illegible] | [illegible] | [illegible] | 168 hr | [illegible] | [illegible] | [illegible] | 9.2 |

a/ Based on [illegible]-hr periods per run plus [illegible] hr startup; excludes shutdown.
b/ Based on 24-hr periods per run including startup and shutdown periods.
c/ Based on [illegible]-hr periods per run plus [illegible] hr startup; includes shutdown.
d/ lb = Pounds emissions
kg = Kilograms emissions
lb/ton = Pounds emissions per ton charcoal produced (based on [illegible] tons charcoal)
kg/Mton = Kilograms emissions per metric ton charcoal produced (based on [illegible] Mtons charcoal)
e/ Values for Run No. 1 are approximate.

The data for the 3-hr start-up period are added to form the total emission factor for the burn cycle. This method does not include the shut-down period of the cycle. The second method utilizes the data from each run as representative of the emissions over a 28-hr period around each sample time. This method includes the start-up and shut-down periods. The last method takes the data from each run as being consistent with that of a 27.5-hr period around each sample time. The data for the start-up period are added to form the total while the shut-down period is included. These methods yield total emission factors ranging from 126.4 to 160.5 lb of emissions per ton of charcoal produced (63.2 to 80.2 kg of emissions per metric ton of charcoal produced).

Table 5 presents the same data but figured as unit emissions per unit wood used in the charcoal production. These data were computed by the same three methods as that for Table 4. The results range from 26.8 to 34.1 lb emissions per ton wood utilized (13.4 to 17.0 kg emissions per metric ton wood utilized).

Table 6 presents a summary of the ORSAT results for the stack gas compositions. Values for the percent by volume of carbon monoxide and carbon dioxide generally increased over the period of the burn while that for oxygen generally decreased. These values may be in error somewhat due to the presence of volatile hydrocarbons in the gas stream, but are thought to be representative.

Percent moisture values ranged from 25.5 to 35% (by volume) for the six daily runs. These values are at or slightly below moisture saturation. The value for the volume of water collected was back-calculated using the standard equation for those runs at moisture saturation (these values were needed for entry with the computer program). The value for $\Delta p$ at each point found in the computer printouts of the field data in the appendices was back-calculated from the input velocity data, since no direct $\Delta p$ readings were obtained by pitot readings due to the low flow. These values are shown merely to indicate approximate readings that would be expected.

## B. Polycyclic Organic Materials

Table 7 presents a summary of the POM results for the six runs. Data are presented as grains x $10^{-6}$ per dry standard cubic foot, milligrams per 1,000 cubic meters, pounds emissions x $10^{-6}$ per hour, and micrograms emissions per hour. Computer printouts of the field data and reductions may be found in Appendix D. The sample calculations are the same as for the mass data.

# TABLE 5

## SUMMARY OF MASS EMISSION FACTORS (WOOD UTILIZATION)

METHOD I a/

| Run No. | Period covered | Total mass emissions lb d/ | Total mass emissions kg d/ | Emission factor lb/ton d/ | Emission factor kg/Mton d/ |
|---|---|---|---|---|---|
| 1 e/ | 1240-1540 December 2, 1975 | [illegible] | [illegible] | [illegible] | [illegible] |
| 3 | 1540 December 2<br>1540 December 3 | [illegible] | [illegible] | [illegible] | [illegible] |
| 5 | 1540 December 3<br>1540 December 4 | [illegible] | [illegible] | [illegible] | [illegible] |
| 7 | 1540 December 4<br>1540 December 5 | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | 1540 December 5<br>1540 December 6 | [illegible] | [illegible] | [illegible] | [illegible] |
| 11 | 1540 December 6<br>1540 December 7 | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | 1540 December 7<br>1540 December 8 | [illegible] | [illegible] | [illegible] | [illegible] |
| Total | 1[illegible]7 hr | [illegible] | 1,1[illegible]1 | [illegible] | [illegible] |

METHOD II b/

| Run No. | Period covered | Total mass emissions lb d/ | Total mass emissions kg d/ | Emission factor lb/ton d/ | Emission factor kg/Mton d/ |
|---|---|---|---|---|---|
| 1 e/ | | | | | |
| 3 | [illegible] December 2<br>[illegible] December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 5 | [illegible] December [illegible]<br>[illegible] December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 7 | [illegible] December [illegible]<br>[illegible] December 5 | 1,11[illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] December [illegible]<br>[illegible] December [illegible] | [illegible]21 | [illegible] | [illegible] | [illegible] |
| 11 | [illegible] December [illegible]<br>[illegible] December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] December [illegible]<br>[illegible] December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Total | 168 hr | [illegible] | [illegible] | [illegible] | [illegible] |

METHOD III c/

| Run No. | Period covered | Total mass emissions lb d/ | Total mass emissions kg d/ | Emission factor lb/ton d/ | Emission factor kg/Mton d/ |
|---|---|---|---|---|---|
| 1 e/ | 1240-1540 December 2, 1975 | [illegible] | [illegible] | [illegible] | [illegible] |
| 3 | [illegible] December 2<br>[illegible] December 3 | [illegible] | [illegible] | [illegible] | [illegible] |
| 5 | 1910 December 3<br>2240 December 4 | [illegible] | [illegible] | [illegible] | [illegible] |
| 7 | 2240 December 4<br>[illegible] December 5 | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] December 5<br>0540 December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 11 | 0540 December [illegible]<br>0910 December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | 0910 December [illegible]<br>1240 December [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Total | 168 hr | [illegible] | 1,[illegible]11 | [illegible] | 17.0 |

a/ Based on [illegible]-hr periods per run plus [illegible] hr start-ups; includes shutdown.
b/ Based on 24-hr periods per run including start-up and shutdown periods.
c/ Based on [illegible]-hr periods per run plus [illegible] hr start-up; includes shutdown.
d/ lb = Pounds emissions
kg = Kilograms emissions
lb/ton = Pounds emissions per ton wood utilized (based on [illegible] tons wood)
kg/Mton = Kilograms emissions per metric ton wood utilized (based on [illegible] Mtons wood)
e/ Values for Run No. 1 are approximate.

## TABLE 6

## SUMMARY OF ORSAT RESULTS

| Date | Stack | Time | Percent by volume $CO_2$ | $O_2$ | CO | $N_2$ | Molecular weight dry stack gas (lb/lb-mole) |
|---|---|---|---|---|---|---|---|
| December 3, 1975 | 7 | 1000 | 9.83 | 10.67 | 1.73 | 77.80 | 29.99 |
| | 3 | 1255 | 8.67 | 11.53 | 1.73 | 78.07 | 29.85 |
| | 5 | 1530 | 14.40 | 5.33 | 2.20 | 78.07 | 30.52 |
| | Average (Runs Nos. 1, 2, 3) | | 10.96 | 9.17 | 1.88 | 77.98 | 30.12 |
| December 4, 1975 | 2 | 0900 | 17.33 | 6.87 | 4.00 | 72.13 | 30.99 |
| | 8 | 1230 | 13.33 | 7.73 | 1.87 | 77.60 | 30.39 |
| | Average (Runs Nos. 4, 5) | | 15.33 | 7.30 | 2.93 | 74.77 | 30.69 |
| December 5, 1975 | 6 | 0830 | 12.67 | 8.53 | 2.53 | 76.27 | 30.37 |
| | 2 | 1200 | 12.27 | 11.73 | 2.60 | 73.40 | 30.43 |
| | 8 | 1400 | 26.73 | 7.40 | 7.27 | 58.60 | 32.57 |
| | Average (Runs Nos. 6, 7) | | 17.22 | 9.22 | 4.13 | 69.42 | 31.12 |
| December 6, 1975 | 7 | 0900 | 14.60 | 7.93 | 1.33 | 76.13 | 30.65 |
| | 7 | 1000 | 17.53 | 4.87 | 1.67 | 75.93 | 31.09 |
| | Average (Runs Nos. 8, 9) | | 16.07 | 6.40 | 1.50 | 76.03 | 30.83 |
| December 7, 1975 | 4 | 0940 | 22.17 | 2.37 | 7.07 | 68.40 | 31.64 |
| | 8 | 1130 | 21.00 | 2.40 | 6.40 | 70.20 | 31.46 |
| | 6 | 1300 | 11.40 | 1.60 | 3.00 | 75.00 | 30.25 |
| | Average (Runs Nos. 10, 11) | | 18.19 | 5.12 | 5.49 | 71.20 | 31.12 |
| December 8, 1975 | 8 | 0900 | 22.67 | 0.87 | 8.20 | 68.27 | 31.66 |
| | 1 | 1300 | 22.00 | 1.40 | 5.13 | 71.47 | 31.58 |
| | Average (Runs Nos. 12, 13, 14) | | 22.33 | 1.13 | 6.67 | 69.87 | 31.62 |

TABLE 7

SUMMARY OF POLYCYCLIC ORGANIC MATERIAL RESULTS

| Run No. | Date | POM material[a/] | Total POM loads[b/] — Partial[c/] gr/dscf[d/] | Partial mg/1,000 cm[d/] | Partial lb/hr[d/] | Partial μg/hr[d/] | Total gr/dscf[d/] | Total mg/1,000 cm[d/] | Total lb/hr[d/] | Total μg/hr[d/] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Burn-cycle | | | | | | | | | |
| 2 | December 3, 1975 | 1 | 15.2 | 34.7 | 44.2 | 20.0 | 15.2 | 34.7 | 44.2 | 20.0 |
| | | 2 | ND[e/] | ND | ND | ND | ND | ND | ND | ND |
| | | 3 | 339.7 | 777.3 | 989.3 | 448.7 | 370.2 | 847.7 | 1,078.2 | 489.0 |
| 4 | December 4 | 1 | 3.3 | 7.5 | 9.4 | 4.2 | 22.6 | 51.6 | 64.6 | 29.3 |
| | | 2 | 3.3 | 7.5 | 9.4 | 4.2 | 13.8 | 31.5 | 39.4 | 17.9 |
| | | 3 | 137.8 | 315.1 | 394.6 | 179.0 | 205.3 | 469.7 | 587.8 | 266.6 |
| 6 | December 5 | 1 | 12.4 | 28.4 | 27.6 | 12.6 | 12.4 | 28.4 | 27.6 | 12.6 |
| | | 2 | 3.6 | 8.1 | 8.0 | 3.7 | 8.1 | 18.6 | 18.1 | 8.2 |
| | | 3 | 77.9 | 178.1 | 174.1 | 78.6 | 118.6 | 271.4 | 263.5 | 119.5 |
| 8 | December 6 | 1 | ND | ND | ND | ND | 26.7 | 61.0 | 55.9 | 25.3 |
| | | 2 | ND | ND | ND | ND | 8.9 | 20.3 | 18.6 | 8.5 |
| | | 3 | ND | ND | ND | ND | 257.3 | 588.7 | 538.7 | 244.4 |
| 10 | December 7 | 1 | ND | ND | ND | ND | 12.7 | 29.1 | 24.7 | 11.2 |
| | | 2 | ND | ND | ND | ND | 20.7 | 47.4 | 40.3 | 18.2 |
| | | 3 | 197.3 | 451.6 | 383.8 | 174.1 | 511.8 | 1,174.1 | 997.8 | 452.6 |
| 12 | December 8 | 1 | ND | ND | ND | ND | 51.0 | 116.7 | 72.8 | 33.0 |
| | | 2 | ND | ND | ND | ND | 69.2 | 158.4 | 85.9 | 38.9 |
| | | 3 | 837.0 | 1,915.4 | 1,196.2 | 541.9 | 1,685.3 | 3,855.0 | 2,120.0 | 961.7 |

a/ 1 = Benz[c]phenanthrene
2 = Benz[a]pyrene
3 = POM-like material
All other POM's not detectable.

b/ Total for all stacks emitting during tests; 8 stacks for Runs Nos. 2, 4, 6, and 10; 7 stacks for Runs Nos. 8 and 12; grains per dry standard cubic feet and milligrams per 1,000 cubic meters irrespective of number of stacks.

c/ Partial = Front half of sampling train only (probe, first filter)
Total = Entire train

d/ gr/dscf = Grains x $10^{-3}$ per dry standard cubic foot
mg/1,000 cm = Milligrams per 1,000 dry standard cubic meters
lb/hr = Pounds emissions x $10^{-6}$ per hour
μg/hr = Micrograms emissions per hour

e/ ND = Not detectable.

The six sets of samples were analyzed for the following POMs:

Benz[c]phenanthrene

Benz[a]pyrene

Dibenz[a,h]anthracene

3-Methylcholanthrene

7,12-Dimethylbenz[a]anthracene

3,4,5,6-Dibenzocarbazole

Other materials found on the chromatograms were classified as POM-like materials. These were defined as the total of unassigned peaks eluting after 3-methylcholanthrene, and may reflect the degree of clean-up. They were classed together and reported like the other POMs. Detectable quantities were found only for benz[c]phenanthrene, benz[a]pyrene, and the POM-like material. Quantities for the other POMs, if present, were below the detection limits for the given sample volumes. The ranges of the detection limits for the various POMs were as follows:

Benz[c]phenanthrene: 1.2 to 4.1 μg/sample

Benz[a]pyrene: 1.0 to 2.0 μg/sample

Dibenz[a,h]anthracene: 1.5 to 4.5 μg/sample

3-Dimethylcholanthrene: 0.4 to 0.8 μg/sample

7,12-Dimethylbenz[a]anthracene: 1.0 to 2.0 μg/sample

3,4,5,6-Dibenzocarbazole: 4.0 to 10.0 μg/sample

C. Visible Emissions

Observations of the visible emissions according to procedures established in EPA's Method 9[1] were not made. However, frequent observation of the stacks by two trained, but not currently certified, observers indicated that the opacity was seldom, if ever, lower than 100%. As compliance testing was not involved, it is felt that these observations are valid as indicators of the general state of the visible emissions from an operating charcoal kiln.

As the stack gas was at or near moisture saturation, some steam may be included in the visible emissions, causing problems with the readings. The plumes of the several stacks and kilns readily mingle, making readings from any one stack difficult at times.

D. Heat of Combustion

Table 8 presents a summary of the heat of combustion data for the five cryogenic samples. The heat of combustion values are given for both the water and tar and oil fractions as recovered from the sampling apparatus. The heats of vaporization given are for the amounts of water collected. The net heat available from the flue gas stream is found by summing the heats of combustion for each sample and subtracting the respective heats of vaporization. The air/fuel ratios are approximate values for the volume of air per unit volume of flue gas needed for stoichiometric combustion of the flue gas. The stoichiometric heat indicates the quantity of heat required to combust the flue gas stream and added air under stoichiometric conditions. The negative values indicate that an additional fuel source must be provided as the flue gas stream will not sustain combustion of itself. Additional information may be found in Appendix E.

## III. PROCESS DESCRIPTION AND OPERATION

A. Process Description

Charcoal in Missouri is manufactured by means of the pyrolysis, or destructive distillation of wood, utilizing the kiln method.[2-4] The wood is heated in generally air tight ovens using controlled amounts of air. Wood moisture, volatiles, and combustion gases are driven off by the high temperatures generated. Combustion of part of the wood volatiles produces heat to sustain the carbonization process. The waste gases are emitted to the atmosphere through the kiln stacks leaving a product of highly carbonized charcoal, along with some partially charred wood which may be used in subsequent kiln loadings. Approximately 4,000 lb (1,814 kg) of wood must be used to obtain 1,000 lb (454 kg) charcoal.

TABLE 8

HEATS OF COMBUSTION

| Date | Volume flue gas sampled (cf)[b] | Sample No. | Fraction | Sample weight (g)[b] | Heat of combustion[a] (cal/g)[b] | Heat of vaporization (water) (cal)[b] | Net heat available from flue gas stream (cal)[b] | Air/fuel ratio | Stoichiometric heat (cal)[b] |
|---|---|---|---|---|---|---|---|---|---|
| December 4, 1975[c] | [illegible].84 | 1-1 | Water | [illegible] | [illegible] | - 4,685 | - 1,[illegible] | [illegible]6 | - [illegible] |
| | | 1-2 | Tar and oil | .6 | 1,185 | | | | |
| December 6[c] | [illegible].94 | 2-1 | Water | 4.6 | [illegible] | - 2,565 | - [illegible] | [illegible]6 | - 11,[illegible] |
| | | 2-2 | Tar and oil | .6 | 7,[illegible] | | | | |
| December 7[c] | 1.88 | 3-1 | Water | 15.[illegible] | [illegible] | - 8,84[illegible] | + [illegible],165 | 5[illegible] | - 21,3[illegible] |
| | | 3-2 | Tar and oil | 1.2 | 7,[illegible] | | | | |
| December 8[d] | 2.57 | 4-1 | Water | 11.[illegible] | [illegible] | - 5,58[illegible] | + 1,65[illegible] | 48 | - 16,6[illegible] |
| | | 4-2 | Tar and oil | .6 | [illegible] | | | | |
| | [illegible] | 5-1 | Water | 11.[illegible] | [illegible] | - [illegible] | - [illegible] | 48 | - 16,6[illegible] |
| | | 5-2 | Tar and oil | .6 | [illegible] | | | | |

a/ Analysis done by Kansas City Testing Laboratories.
b/ cf = Cubic feet (actual)
cal/g = Calories per gram
cal = Calories
g = Grams
c/ Samples collected under dry ice-alcohol conditions.
d/ Samples collected under ice-salt water conditions.

A typical Missouri-type kiln is shown in Figure 1. Wood is loaded through the door and the roof ventilation ports leaving some air space along the bottom of the kiln. The fire is usually started at the bottom center of the kiln using kindling or other easily combustible materials placed there during loading. During the start-up phase, the door and roof ventilation ports are left open. The ports are closed first after approximately 1 hr and then the doors are closed after 2 to 3 hr. Combustion air inflow is then provided through the use of air pipes near the floor and controlled to prevent complete ashing of the wood. Stack gas velocities are only slightly greater than natural convection and may cease altogether at times in any given stack, depending on the location of hot spots in the kiln, and wind direction and velocity. Generally, the burn is completed when the fire has reached the floor of the kiln, having burned from top to bottom and center to walls. At this time, all openings are sealed off, preventing further air inflow or waste gas emission, killing the fire, and allowing the kiln to cool.

Burn times vary with the type and size of kiln, operator experience and practice, the type of wood used, and the degree of carbonization or quality of product desired. A typical cycle may be within the time frames given below:

1-2 days to load;
5-8 days to burn;
10-14 days to cool; and
1-2 days to unload.

The kilns are generally of concrete construction and may have exposed walls or earthen embankments to provide insulation. Stacks may be constructed of many materials but are usually of 6 to 8 in. (15.2 to 20.3 cm) diameter clay sewer pipe with water pipe and galvanized stove pipe also being used. Stack heights may vary from kiln to kiln or among stacks of a given kiln. No emission control devices are known to be in operation in Missouri on Missouri-type kilns.

## B. Process Operation

The kiln tested at the Wulff Charcoal Company, Vienna, Missouri, operates as a typical Missouri-type charcoal kiln. Drawings of the kiln are presented in Figure 2. The kiln has been in operation for 25 to 30 years. The wood utilized is generally white (post) oak, and may be either fresh cut cordwood, aged (dried) cordwood, or sawmill waste bark-edge slabwood. Prior to this test series, the kiln owner had several truck loads of the various wood types measured and weighed to obtain an average pounds per cubic foot (pcf) value for the wood used in this test kiln. This value is probably very representative as the wood is stacked as

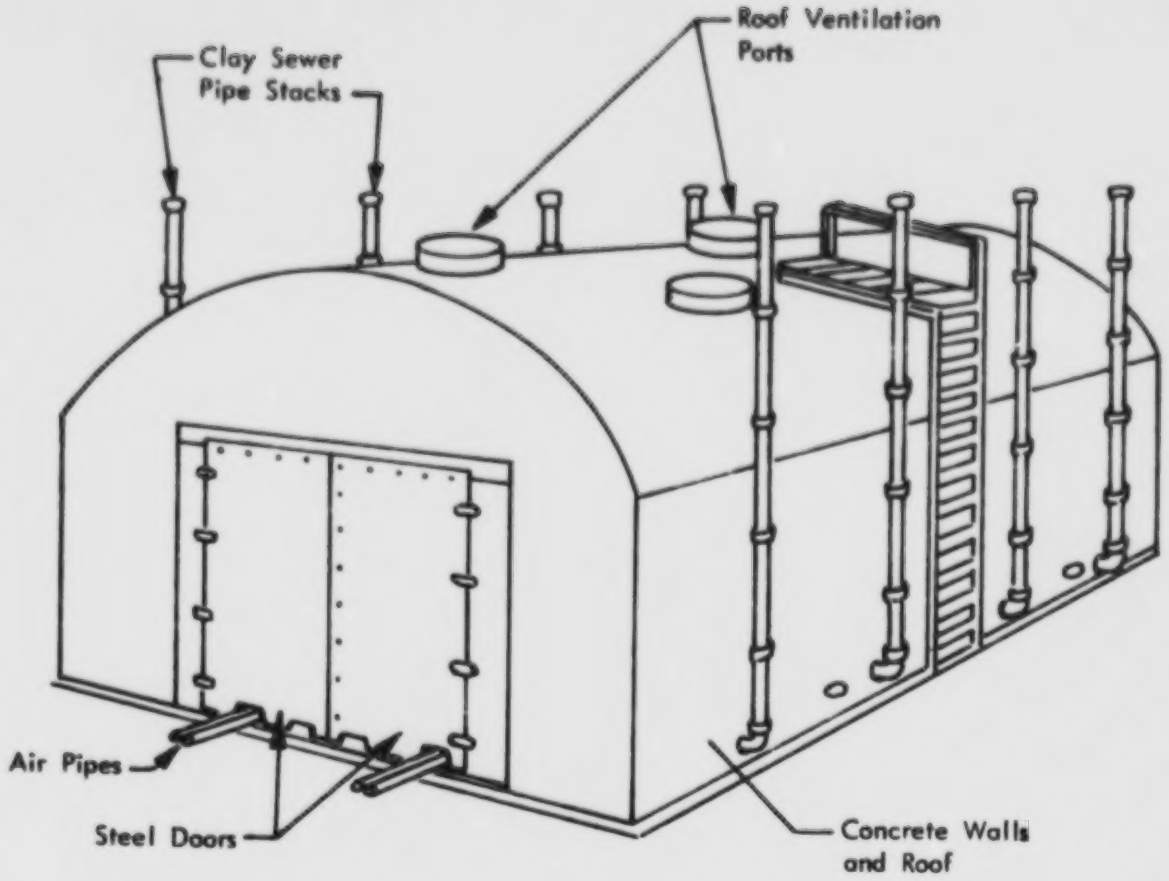
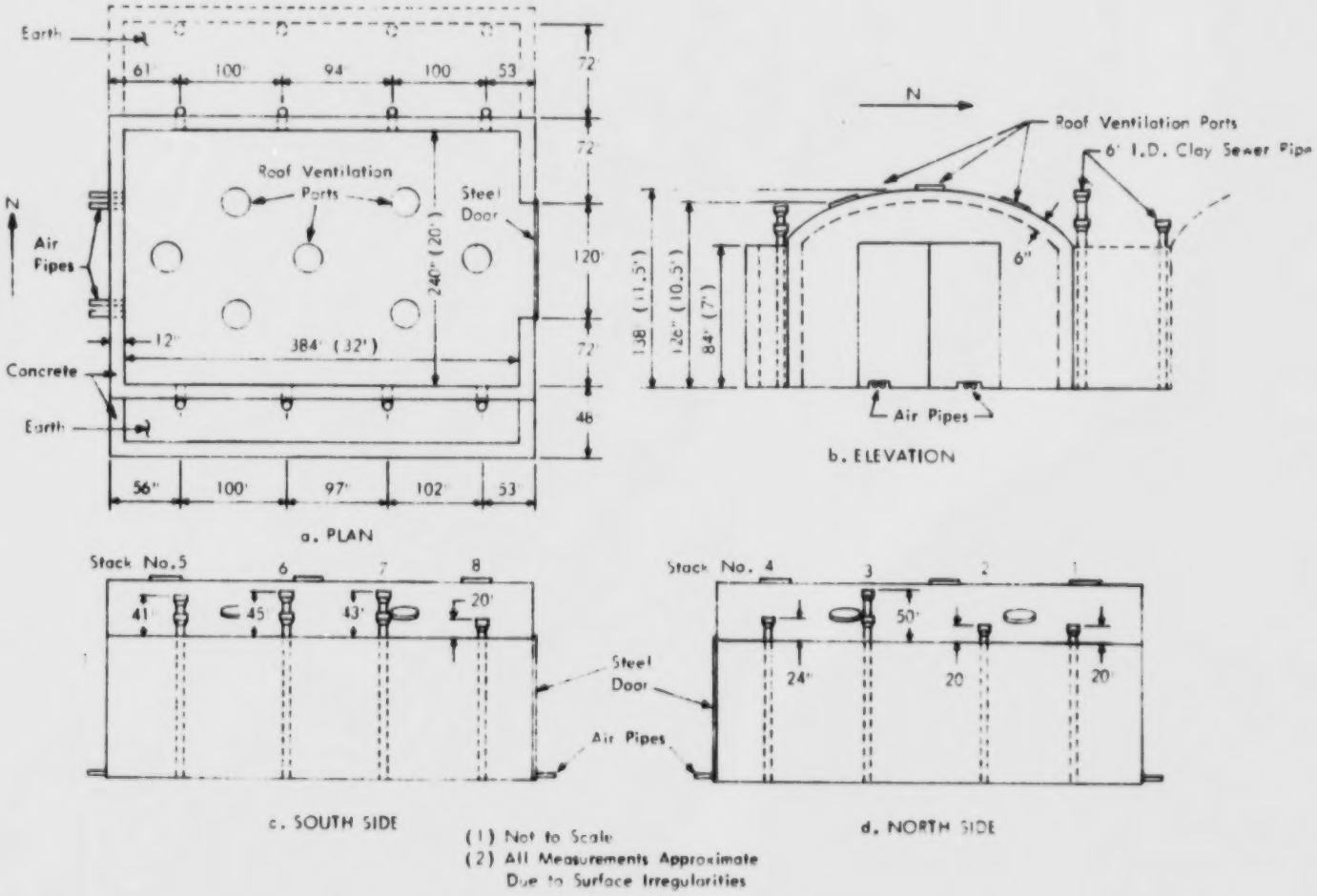



Figure 1 - The Missouri-Type Charcoal Kiln




(1) Not to Scale
(2) All Measurements Approximate Due to Surface Irregularities

Figure 2 - Drawings of Sampled Kiln

tightly in the kiln as it is on the truck. The average value obtained was 29.5 pcf (472.5 kg/cu m). Thus, this kiln has a capacity of approximately 191,300 lb (86,790 kg) or 50.5 cords of wood. Calculations relating to the kiln volume are found in Appendix F. Allowing for air space left around the walls and roof and provided on the floor, the usable wood volume would be approximately 45 cords (169,920 lb, 77,074 kg), which will be used as the capacity for this test. As most of the charcoal produced by Wulff Charcoal is used for industrial purposes, they try to obtain a higher degree of carbonization than is normal. This also yields a lower amount of charcoal per cord of wood than is normal, only around 800 lb (363 kg) charcoal per cord. Thus, the charcoal production of the kiln for this test would be approximately 36,000 lb (16,330 kg).

The kiln was loaded and ready to be lit by noon, Tuesday, December 2, 1975. Figure 3 presents a comparison of the kiln burn cycle with the sampling test cycles. At first, the closed door was not completely sealed but gradually the kiln was sealed such that only the air pipes and exhaust stacks remained open. Close-down began on the afternoon of Monday, December 8, 1975, with the sealing of two exhaust stacks and was completed by approximately noon, Tuesday, December 9, 1975, yielding a 7-day burn cycle.

## IV. SAMPLING AND ANALYTICAL PROCEDURES

### A. Sampling

Due to the nature of the charcoal kiln itself and the types of materials emitted in the waste gas stream, in addition to the general lack of information relating to the testing of a kiln during operation, a portion of the task was to evolve a sampling train and technique that would handle the effluent constituents with reasonable ease.

Various sampling techniques were examined for use on the project. One was to sample each emitting stack each day. This would yield up to eight samples per day. However, as the proper recovery of samples is time consuming, this method of sampling would not be practical for use during 1 day. Another technique would be to composite several stacks into one sample, yielding one to four samples per day. By compositing samples from all emitting stacks into one daily sample, a closer compromise between the task objectives and an amount of work that could reasonably be done in 1 day could be achieved. Thus, it was decided to sample each emitting stack once per day, compositing the samples together for one sample or run per day. Each stack would be sampled for the same amount of time on a given day.

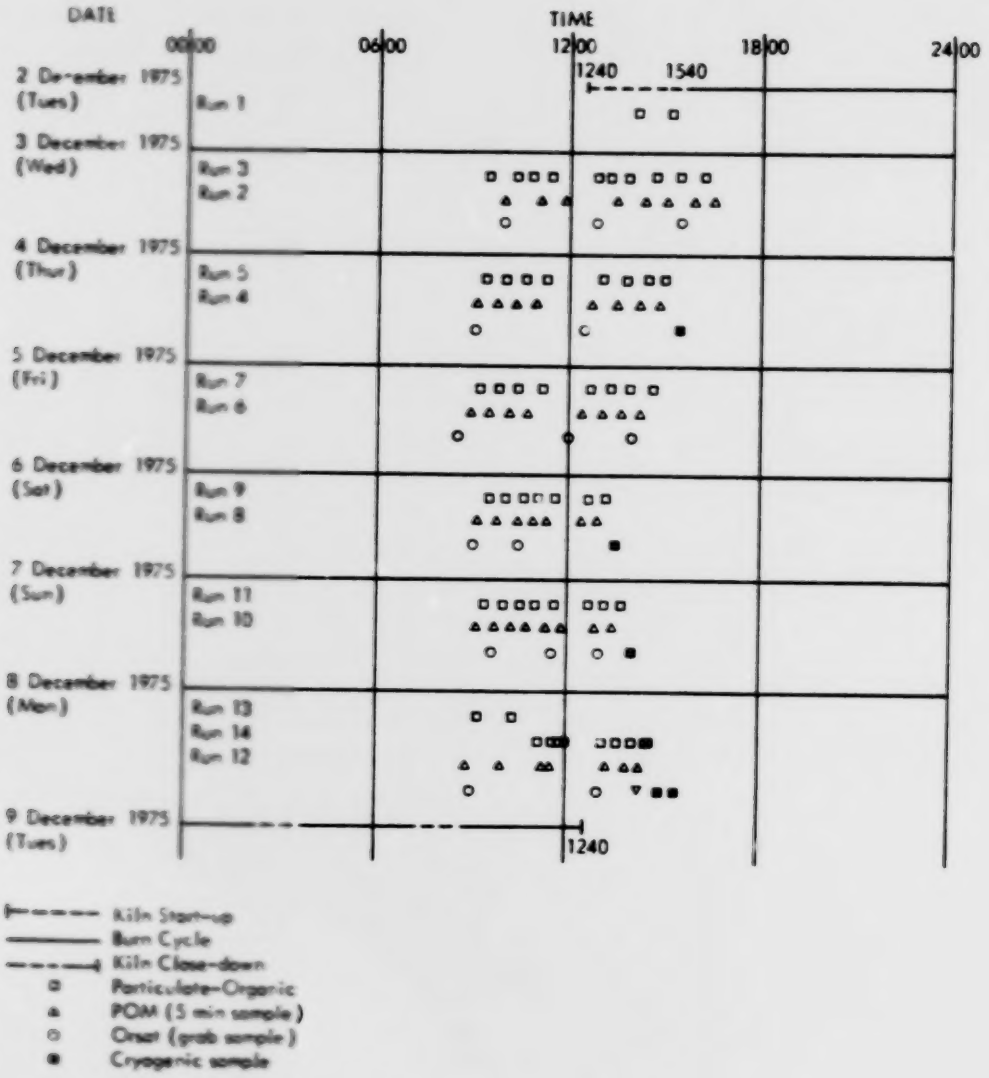



Figure 3 - Schedule of Burn and Testing Cycles

In order to do the actual testing, basically two train configurations were considered. The first method would involve manifolding the stacks together and sampling the common duct. This method would involve considerable problems in material deposition in the manifold ducting and possible disruption of the normal operation of the kiln or the natural draft of the stacks. It was rejected in favor of the other method. By sampling each emitting stack in turn with the same sampling apparatus without sample cleanup between stacks, samples from the individual stacks would be automatically combined for a daily average. It was felt that by using this sampling method and by modifying the standard EPA Method 5 sampling train,[1/] a workable system would result.

1. Mass and total organics

a. Preliminary tests: As tars and oils, present in the waste gas stream, were predicted to plug a glass-fiber filter easily, the filter was moved from its normal position at the front of the train to the rear, just ahead of the silica gel (Figure 4). Also, as the presence of polycyclic organic matter (POM) in the effluent stream was being investigated, 2% sodium carbonate was substituted for distilled water in the first two impingers due to the greater stability of POMs in sodium carbonate. No probe or filter heaters were used. As the stack gas flow rate was very low, glass tubing of approximately 0.5 in. (1.3 cm) ID was used as a probe and probe tip.

To check out this train and related sampling procedures, as well as the analytical techniques, a preliminary series of tests was conducted at a kiln operated by Noblett Charcoal, Belle, Missouri. Two 1/2-hr tests (Runs Nos. 1-P and 2-P) were run on one stack of the kiln during a burn cycle. The impingers were maintained in an ice water bath. Stack gas temperatures were obtained using a thermocouple and potentiometer while stack gas velocities were measured with a Type 3002-2G Alnor Velometer. The velocities were too low for accurate reading using the standard Type-S pitot tube. The velometer presents problems as it is susceptible to ambient wind and possible internal interference due to the oil and tar entrained in the flue gas stream. Sampling was done at a constant, low flow rate of approximately 0.25 actual cubic feet per minute (0.007 actual cubic meters per minute). One flue gas determination by ORSAT analysis was conducted. Moisture determinations were made using the volume of collected water. The probe tip projected into the stack approximately 6 in. (15.3 cm) directly from the top. It was not practicable to establish ports in the stack and extensions were not used in order to disturb the stack draft characteristics as little as possible. Also, no traversing of the stack was done due to the large probe tip size with respect to the small stack size. No general problems were encountered during sampling with this train.

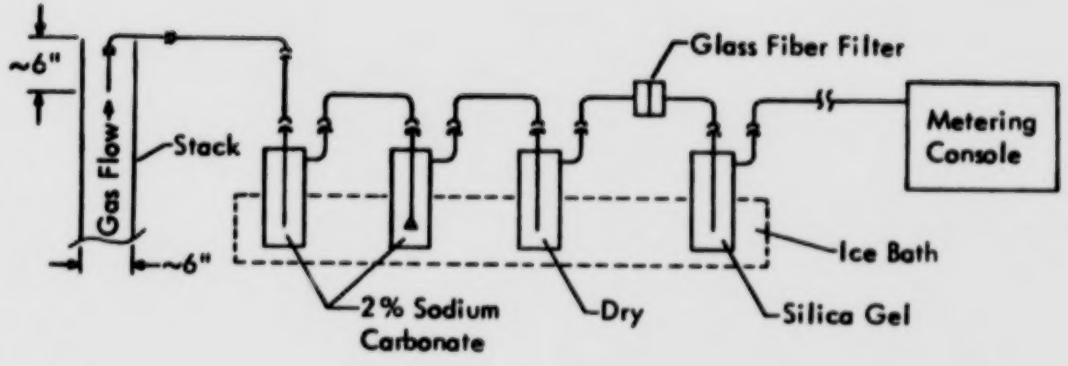



Figure 4 - Preliminary Sampling Train A: Run Nos. 1-P and 2-P

As difficulties, to be dealt with in the analytical section, arose in the analysis of the samples of the first preliminary series, a second preliminary series of testing was done at Wulff Charcoal, Vienna, Missouri. In this series, four train variations were examined, two for the mass and organic analysis and two for the POM analysis, to be examined later. For the mass-organic trains, the standard EPA Method 5 sampling train was used with the inclusion of a filter prior to the silica gel (Figures 5 and 6). The first test (Run No. 3-P) was done with both train filters at atmospheric temperature while the second test (Run No. 4-P) was run with the first train filter heated to approximately 350°F (177°C).

Due to the high moisture content of the flue gas (~ 30% by volume), a considerable amount of water was condensed onto the unheated first filter during Run No. 3-P, filling perhaps one-third the volume of the filter holder. The second filter had no observable material on it after 30-min running time. It is believed that the wet first filter acted as a scrubber removing more material than normal. The wet filter, however, is very difficult to handle.

Run No. 4-P was conducted to eliminate the wet first filter. During this run, the first filter remained dry and was much easier to handle. The second filter was yellow in color after 30-min running time. During both runs, the impinger solutions were cloudy indicating that not all of the flue gas material was captured on the filter and that insoluble materials were present. Also, the filter support frit contained condensed tar and oil. In all cases, the silica gel was discolored, indicating the adsorption of some substance passing through the first filter and liquid-filled impingers.

In order to most closely comply with the EPA Method 5 sampling train for particulates and organic matter, Train C (Figure 6) was chosen for use during the actual test series. This train also had the advantage of eliminating the wet first filter. The first filter was to be heated to 200 to 250°F (93.3 to 121.1°C).

Computer printouts of the field data for the preliminary runs are presented in Appendix G.

b. Test series: Particulate and organic samples were taken with Research Appliance Company Model 2243 "Stacksampler" equipment, modified by MRI. Stack gas temperature readings were taken by thermocouple using a Thermo Electric Minimite Model 31101 potentiometer. Stack gas velocities were taken with the Alnor Velometer, Type 3002-2G.

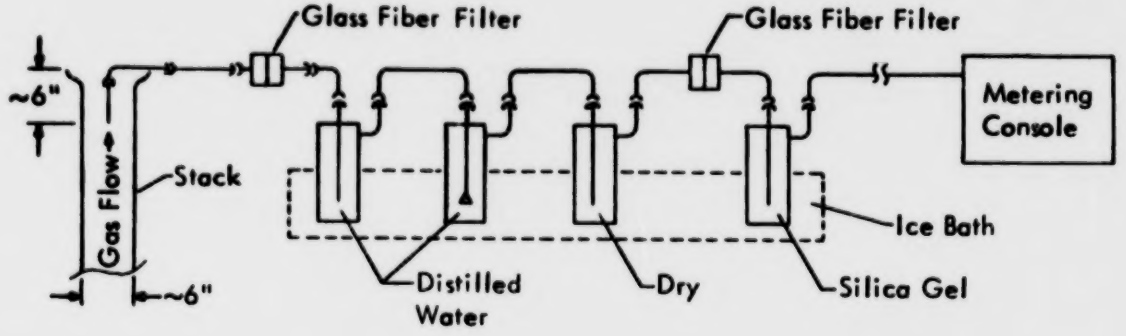



Figure 5 - Preliminary Sampling Train B: Run No. 3-P



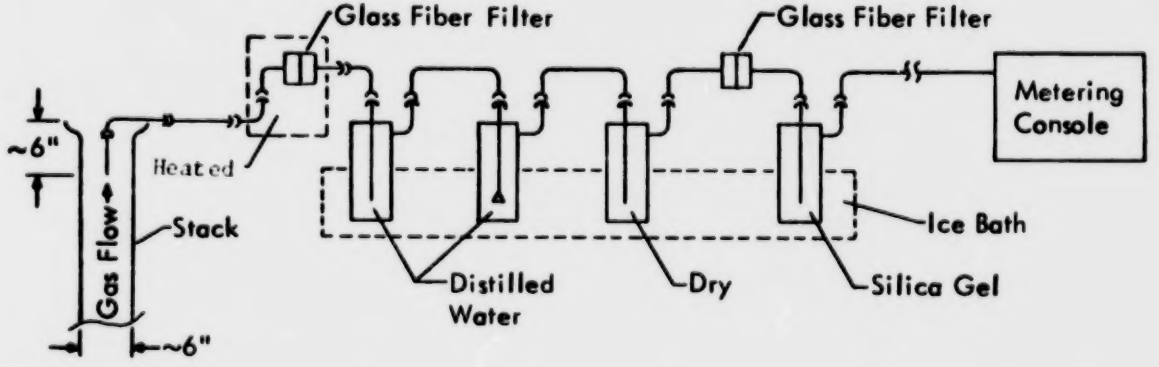



Figure 6 - Preliminary Sampling Train C: Run No. 4-P

No traversing of the stacks was done due to the small diameter of the pipes. As the stacks were made of clay sewer pipe, the cutting of ports was considered impractical and no extensions were added to the stacks in order not to disturb the natural flow characteristics. The probe tip was merely inserted down into the center of the stack approximately 6 in. (15.3 cm). After the preliminary tests, it was believed possible to approach an isokinetic sampling rate by working the EPA isokinetic equation backwards, so to speak, for the actual gas volume to be sampled for each 5-min sampling period. The equation used for this computation is presented in Appendix H.

Sampling times per stack were chosen in order to optimize maximum time and sample volume with minimum operation and cleanup problems. Sample times per stack were as follows:

| | |
|---|---|
| Run No. 3 | 30 min |
| Run Nos. 5, 7 | 20 min |
| Run Nos. 9, 11, 13 | 15 min |
| Run No. 14 | 10 min |

No direct attempt was made to hold to the general EPA guidelines of a 2-hr sample time and 60-dscf sample volume.[1/] Sample times were reduced generally when the number of first filter changes became excessive due to filter plugging (excessive pressure drop) or when such changes were forecast for the following run.

Flue gas velocities were measured every 10 min for each run until Run No. 9, when they were measured once per stack. For each run, these velocities remained fairly constant for each stack, within the precision of the method of measurement. The metering console data and flue gas temperatures were recorded every 5 min throughout the test series. Periodic leak checks of the train were made in order to ensure leak-free operation. In addition, visual examination of the train was made during sampling on nearly every stack to ensure proper functioning.

The relationship between the run times and the burn cycle has been presented in Figure 3. Run No. 1 was made in an attempt to sample emissions during the start-up period. However, after sampling for 5 min on Stack 1, the draft became insufficient and no other stacks emitted until after the doors had been closed. Therefore, Run No. 1 was completed by sampling 25 min with the probe projecting into the plume being emitted out of the front door. A nominal duct diameter of 10 ft (3.048 m) was used in the calculations for Tables 1 through 5. Insufficient time remained on that day after the kiln had been sealed to begin a normal test series.

Standard operation was to intersperse the POM sampling with the particulate-organic sampling. This involved using both trains on a stack in succession before moving to the next stack. Except for the first full day (December 3, Run No. 3), the POM run on a stack preceded the particulate-organic run.

The stacks were sampled in the order 1, 2, 4, 3, 5, 6, 7, 8 except during Runs Nos. 9, 11, 13, and 14. For Run No. 9, Stacks 1 and 2 were not emitting at the start of the test so sampling was begun on Stack 4. Subsequently, Stack 1 began emitting and was sampled last. Stack 2 never emitted and was not sampled. On Run No. 11, Stack 2 did not begin emitting until after the start of the test and so was sampled last. Run No. 13 was terminated during sampling on the second stack as a result of repeated first filter changes and a difficulty in maintaining an isokinetic sampling rate. During Run No. 14, Stacks 4 and 8 ceased emitting and were capped by kiln personnel, Stack 4 after being tested and Stack 8 prior to being tested. During Run No. 7, several stacks were emitting intermittently, or "puffing." This stack condition was determined at the console by continuously monitoring the stack temperature. No sampling was done during periods of no emissions.

During Run No. 3, the train configuration for this and all subsequent runs was changed in that a cyclone and catch-bottle were inserted prior to the first filter to provide a reservoir for the collected water (Figure 7). Due to the high moisture content of the gas stream (~ 30%), the volume of water condensed was such that even by heating the first filter box, all of the moisture could not be maintained in the vapor stage. The cyclone-bottle combination was provided in order to retain this moisture and not have it fill up the horizontal portions of the probe. During some runs, the collected water had to be emptied to prevent overflow. This water was combined with the impinger catch.

Values for the percent moisture by volume of the gas stream were determined in the field by measurement of the volume of water condensate collected. Some of these values were subsequently found to be slightly in excess of the saturation value for the average stack temperature as read from a psycrometric chart. Therefore, the percent moisture values for use in the computer calculations for Runs Nos. 1, 11, 13, and 14 were determined by volume calculations while those of Runs Nos. 3, 5, 7, and 9 were determined from a psychrometric chart. The value for Run No. 1 is very low, probably due to mixing between the atmosphere and the plume emerging from the open kiln door.

Two or three grab samples of the stack gas were taken per day for ORSAT analysis of the stack gas composition. The values obtained were averaged for each days' runs.

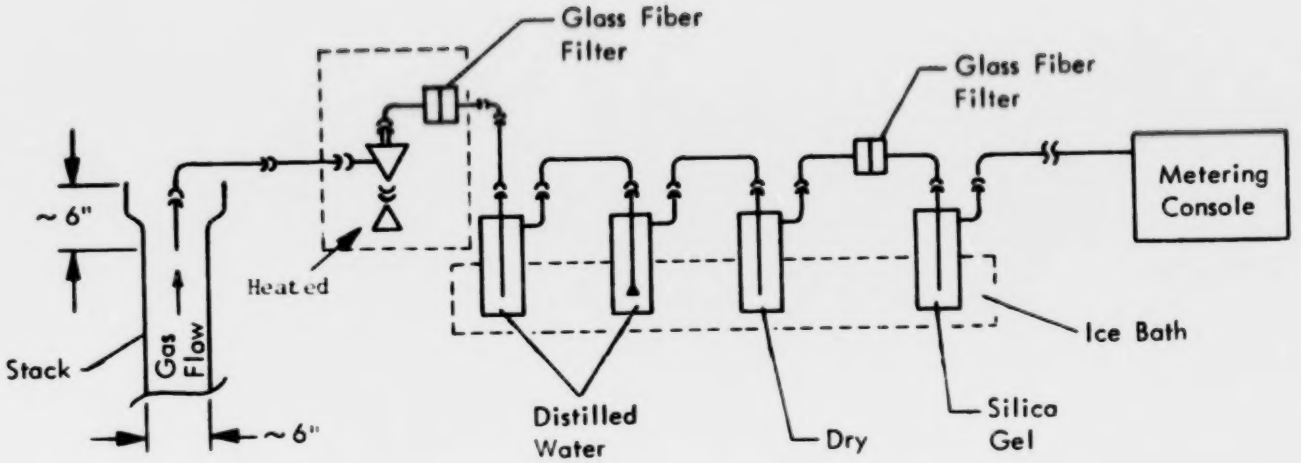



Figure 7 - Sampling Train D: Mass-Organic Test Series

No sampling was done on December 9, 1975, as all of the stacks were either partially or totally capped.

2. Polycyclic organic materials

a. Preliminary tests: After the first preliminary test series, described earlier, the polycyclic organic material (POM) train was modified by placing another filter in front of the sodium carbonate impingers (Figures 8 and 9). This was done in an attempt to clean up the impinger solutions for ease of analysis. The first test (Run No. 5-P) was done with the first filter heated to approximately 350°F (177°C), while the second test (Run No. 6-P) was run with both filters at ambient temperature.

During Run No. 5-P, the first filter remained dry. The second filter was yellow in color after 30 min running time. Run No. 6-P was conducted to see if condensed water would pass through a horizontal filter and frit easier than through a vertical assembly. This proved to be the case but the wet filter was still hard to handle. Again, all impinger solutions were cloudy and the filter support frit contained tar and oil.

For the actual test series, Train E (Figure 8) was chosen in order to maintain a dry first filter and to remove as much material as possible prior to the impinger solutions. The first filter was to be heated to 200 to 250°F (93.3 to 121.1°C).

Computer printouts of the field data for the preliminary runs are presented in Appendix G.

b. Test series: The same sampling equipment and techniques were used for the POM testing as for the particulate-organic testing. POM concentrations in the preliminary samples were found to be of sufficient magnitude to allow for a minimal sampling time during the test series in order to keep the impinger solutions as clean as possible. Sampling times of 5 min/stack were used for all runs. First filters were replaced as necessary.

Flue gas velocities were measured prior to sampling each stack. The metering console data and flue gas temperatures were recorded every 5 min. Periodic leak checks and visual inspections of the train were made to ensure proper functioning.

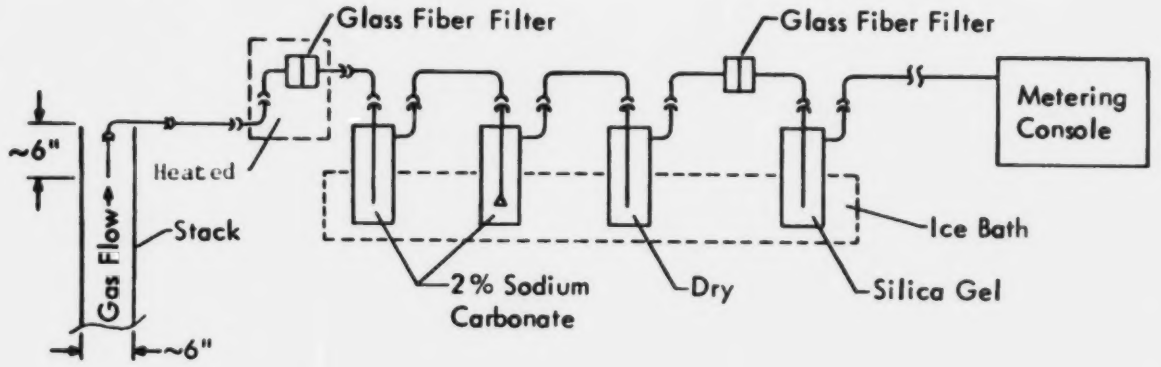



Figure 8 - Preliminary Sampling Train E: Run No. 5-P, POM Test Series



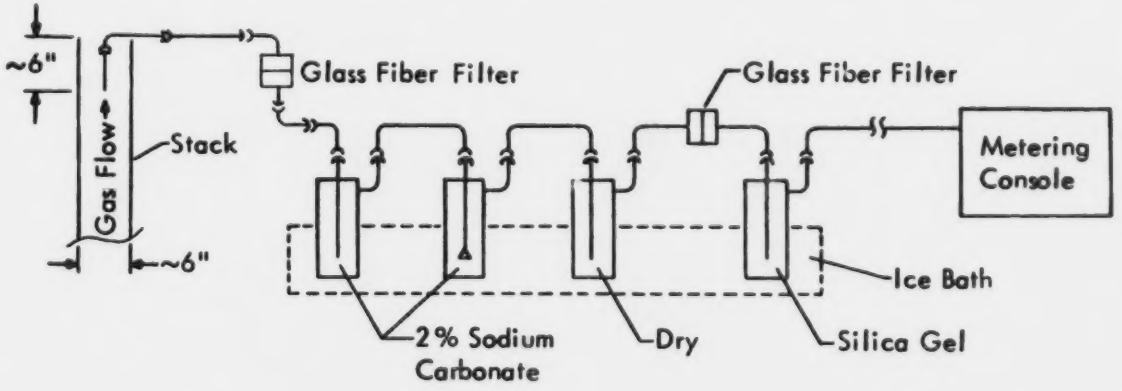



Figure 9 - Preliminary Sampling Train F: Run No. 6-P

The stacks were sampled in the same order as for the particulate-organic train with the same exceptions. For Run No. 8, Stacks 1 and 2 were not emitting at the start of the test, Stack 1 being sampled last and Stack 2 omitted due to lack of emissions. On Run No. 10, Stack 2 did not begin emitting until midway through the test and so was sampled last. During Run No. 12, Run No. 13 (particulate-organic) was terminated. Run No. 12 was held up until Run No. 14 had caught up in the number of stacks sampled. For Run No. 12, Stack 8 was not tested as it was sealed before it could be tested. During Run No. 6, several stacks emitted only intermittantly. This was detected by constant monitoring of the flue gas emperature and no sampling was done during periods of "puffing."

No cyclone assembly had to be added to the train to catch condensed water vapor but moisture collected in the probe elbow prior to the first filter was periodically added to the contents of the first impinger. Percent moisture values were determined as for the particulate-organic train, those for Runs Nos. 10 and 11 calculated from volume computations while those for Runs Nos. 2, 4, 6, and 8 were obtained from a psychrometric chart.

3. Flammability limits and heat of combustion: Another portion of the sampling program was to determine if a flammability limit could be established. This is the amount of air that must be combined with the flue gas stream in order to sustain combustion, data useful in exploring control device possibilities for the kilns.

The apparatus used is shown in Figure 10. The chamber was filled with flue gas using the inlet blower. When this was accomplished, the inlet was directed towards ambient air and the spark or flame source was initiated. The flue gas in the chamber and the incoming ambient air were mixed using the inlet and outlet blowers. Three ignition methods were tried, two spark and one open flame.

Several tests were attempted during the preliminary tests and the actual test series. At no time could the flue gas be made to ignite. It is thought that the high moisture content of the stack gas stream may be responsible for this failure to ignite.

In an attempt to obtain some useful information relating to the combustion qualities of the stack gas, five cryogenic samples were taken during the actual test series in order to determine the heat of combustion of the condensed material. The sampling apparatus is shown in Figure 11. A 0.5-in. ID stainless steel "U"-tube was placed in a dry-ice-ethanol bath (-97.6°F, -72°C) and a sample was drawn at a very low flow rate using the RAC meter console until the trap was sealed with condensed material. For the last two tests, a salt water-ice bath (14°F, -10°C) was substituted for the dry ice-ethanol bath. These samples were run for 15 min but were not cold enough to freeze.

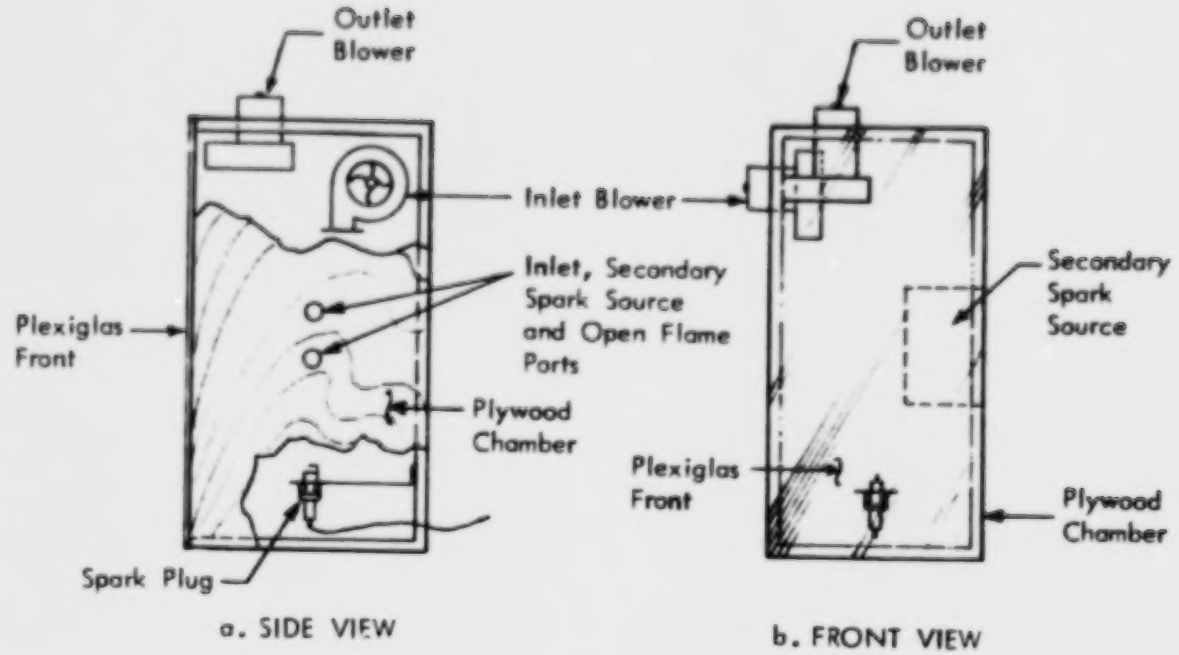



Figure 10 - Flammabilit; Limits Apparatus

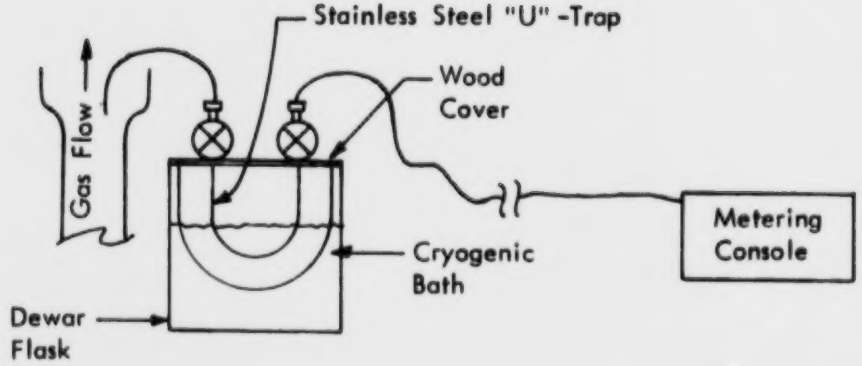



Figure 11 - Cryogenic Sampling Apparatus

B. Analysis

1. Mass and total organics: At the conclusion of each run, the samples were recovered at the sampling site. The filters were placed in clean, wide-mouth glass jars. All filters from a given position in the train, i.e., first or second, for each run were placed in the same jar. All glassware ahead of the first filter was washed with acetone into a clean, narrow-mouth glass bottle and sealed with a poly-seal cap. The impinger water was measured volumetrically and stored in a clean, narrow-mouth glass bottle with a poly-seal cap. The impingers, and all glassware behind the first filter, were then rinsed with acetone into a separate clean, narrow-mouth glass bottle having a poly-seal cap. The silica gel was weighed and discarded. The samples, after recovery, were transported to Kansas City by truck for analysis.

For the first set of preliminary runs, it was believed that the sodium carbonate solution could be utilized for both mass-organic and POM evaluations. However, it was discovered that the sodium carbonate was taken up by the ether-chloroform extraction process, resulting in a white, crystalline mass in the sample extract. Thus, distilled water was used in the impingers for the other preliminary series and for the actual test series.

The mass samples were analyzed as specified in the referenced Federal Register.[1/] To obtain data for the total organics portion of the task, the filters were extracted ultrasonically using three 25-ml portions of chloroform followed by three 25-ml portions of ether. Each portion was decanted from the filter residue using disposable pipettes. The filter particles collected in the ether-chloroform extract were then centrifuged out and rinsed with ether and chloroform until no color was detected in the rinses. The combined ether-chloroform washings were evaporated in an ambient air hood, dessicated, and weighed. This result was compared with that of the total mass filter weight and the organic fraction was determined. This fraction was then applied to the acetone rinses to determine their organic fractions. The total organic load was obtained by summing all of the organic fractions with the result of the ether-chloroform extraction of the impinger water.

2. Polycyclic organic materials: The POM samples were recovered in the field in the same manner as the mass samples except that clean, brown-glass bottles with poly-seal caps were used for all solutions.

The sodium carbonate impinger solutions were extracted in a separatory funnel using three 100-ml portions of cyclohexane. The acetone rinses were evaporated to dryness using a stream of nitrogen gas. They were then extracted with cyclohexane, using 20-, 20-, and 5-ml portions. The filters were extracted ultrasonically using cyclohexane, also using 20-, 20-, and 5-ml portions. The extractions were eluted on 20-gram columns of florisil eluted with 250 ml of 15% ether in hexane. The samples

were analyzed using a Varian Model 1400 gas chromatograph with a scandium tritide electron capture detector. The 6 ft by 2 mm ID glass column was packed with 3% Dexil 300 GC on 100/120 Supelcoport. A nitrogen carrier gas flow rate of 30 ml/min was used. The temperatures utilized for the injection port, column, and detector were 255, 290 and 295°C, respectively.

3. Heat of combustion: The cryogenic samples were recovered after the return to Kansas City. The stainless steel U-traps were opened and the water fraction of each trap poured into a separate clean glass bottle and sealed with a poly-seal cap. The material remaining in each trap was then rinsed with acetone into separate clean glass bottles. The acetone rinses were evaporated to dryness at approximately 55°C, cooled to room temperature, and sealed with poly-seal caps. Both sets of samples were weighed and then sent to Kansas City Testing Laboratories for analysis. The heat of combustion results were obtained by Adiabatic Bomb Calorimeter. Filter paper pellets were used as a fuel source for both the water and the tar and oil fractions. The tar and oil fraction samples were transferred to the bomb cup via filter paper. A slight residue was observed in the bomb cup after each firing, indicating that the values may be on the low side.

## V. RECOMMENDATIONS AND COMMENTS

1. The data presented in this report results from a single series of tests at a single kiln. It is not known how various woods would effect the emission characteristics. Other factors that could play a role are the meterological conditions and kiln operator techniques. Prior to any extensive establishment of regulations regarding the charcoal kiln industry, other tests at other kilns should be considered to evaluate these other factors.

2. It is possible that more uniform mass data could be obtained by sampling with a train that does not employ the first filter, similar to the EPA sampling train for sulfuric acid mist.1/ In this train, the flue gas stream is passed directly to the impingers before going to a final filter. This would eliminate the constant need for replacement of the first filter resulting from heavy loading and excessive pressure drop across the filter. Also, due to the nature of the flue gas stream, the amount of material that passes through the filter is somewhat dependent on the temperature at which the first filter is maintained in the sample box. Because of the variations in the precision of different sample box heaters, the amount of material collected on the first filter could vary from test to test, thus affecting the "front-half" emission calculations. By going to the impingers directly, the need to heat the probe or otherwise handle the condensed flue gas water vapor would be eliminated.

3. The low stack gas velocity inherent in charcoal kiln operation is difficult to measure by normal means. The velometer used in this test worked satisfactorily but as has been mentioned, is affected by ambient wind and possibly by the flue gas constituents. Other methods should be investigated to determine the most suitable.

4. Further work needs to be done to determine the combustion characteristics of the flue gas stream if control methods are envisioned for the charcoal industry. Enhanced combustion might be achieved by removing all or part of the water vapor from the flue gas stream. The possibility of using charcoal as the heat source for waste gas combustion might also be explored.

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1. Environmental Protection Agency, "Standards of Performance for New Stationary Sources," Federal Register, Vol. 36, No. 159, Part II, Tuesday, August 17, 1971.

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3. Jarvis, J. Pitts, Jr., "The Wood Charcoal Industry in the State of Missouri," Engineering Series Bulletin No. 48, Engineering Experiment Station, University of Missouri at Columbia, Vol. 61, No. 21, Columbia, Missouri, May 2, 1960.

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6. Dean, John A. (ed.), Lange's Handbook of Chemistry, 11th Ed., McGraw-Hill Book Company, New York (1973).

APPENDIX A

RESULTS OF ANALYSIS - COMPUTER COMPUTATIONS
(TOTAL PARTICULATE)

TABLE A-1

PARTICULATE DATA AND CALCULATED VALUES

RUN- 1 DATE- 12-02-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 60.0 | 29.26 | 0.00 | 31.0 | 786.70 | 955.70 | | 801.61 | 9.2 | 11.0 | 1.9 | .850 |

| PORT-POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.00 | 802.84 | .002 | .150 | 62.0 | 62.0 | 1.0 | 62.0 | | .600 | 150.0 |
| 0 | 5.00 | 804.15 | .008 | .250 | 64.0 | 64.0 | 1.0 | 50.0 | | .600 | 300.0 |
| 0 | 5.00 | 806.04 | .008 | .400 | 67.0 | 64.0 | 2.0 | 50.0 | | .600 | 300.0 |
| 0 | 5.00 | 808.02 | .008 | .450 | 72.0 | 64.0 | 2.5 | 50.0 | | .600 | 300.0 |
| 0 | 5.00 | 810.29 | .008 | .550 | 80.0 | 68.0 | 4.0 | 50.0 | | .600 | 300.0 |
| 0 | 5.00 | 812.96 | .008 | .850 | 85.0 | 69.0 | 5.5 | 50.0 | | .600 | 300.0 |

TABLE A-2

PARTICULATE DATA AND CALCULATED VALUES

RUN- 3 DATE- 12-03-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.31 | 0.00 | 675.2 | 2162.50 | 4855.10 | .20 | 813.01 | 9.2 | 11.0 | 1.9 | .850 |

| PORT- | POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GFL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 814.74 | .006 | .400 | 42.0 | 44.0 | 2.5 | 145.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 816.47 | .006 | .350 | 46.0 | 44.0 | 2.5 | 140.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 818.17 | .006 | .330 | 56.0 | 44.0 | 3.0 | 140.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 819.87 | .006 | .350 | 59.0 | 45.0 | 4.0 | 140.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 821.61 | .006 | .370 | 66.0 | 48.0 | 7.0 | 140.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 823.47 | .006 | .400 | 69.0 | 49.0 | 7.5 | 140.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 825.05 | .006 | .300 | 56.0 | 55.0 | 11.0 | 150.0 | 50.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 826.78 | .006 | .400 | 61.0 | 56.0 | 14.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 828.66 | .006 | .440 | 72.0 | 58.0 | 14.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 830.53 | .006 | .400 | 64.0 | 59.0 | 4.0 | 145.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 832.47 | .006 | .350 | 72.0 | 60.0 | 9.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 834.18 | .006 | .350 | 74.0 | 61.0 | 9.0 | 150.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 836.32 | .009 | .550 | 65.0 | 62.0 | 10.0 | 130.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 838.47 | .009 | .530 | 71.0 | 63.0 | 6.5 | 130.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 840.48 | .007 | .450 | 79.0 | 64.0 | 6.5 | 135.0 | | .600 | 320.0 |
| 4 | 1 | 5.00 | 842.42 | .007 | .400 | 80.0 | 65.0 | 6.5 | 135.0 | | .600 | 320.0 |
| 4 | 1 | 5.00 | 844.38 | .009 | .500 | 85.0 | 66.0 | 8.0 | 130.0 | 50.0 | .600 | 350.0 |
| 4 | 1 | 5.00 | 846.64 | .009 | .550 | 87.0 | 68.0 | 9.0 | 135.0 | | .600 | 350.0 |

TABLE A-2 (Concluded)

RUN- 3 DATE- 12-03-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1 | 5.00 | 848.58 | .006 | .500 | 65.0 | 66.0 | 11.0 | 145.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 850.39 | .006 | .400 | 70.0 | 66.0 | 11.0 | 145.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 852.26 | .008 | .450 | 80.0 | 67.0 | 14.0 | 145.0 | 50.0 | .600 | 350.0 |
| 3 | 1 | 5.00 | 854.17 | .008 | .400 | 83.0 | 68.0 | 15.0 | 145.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 856.33 | .009 | .500 | 81.0 | 70.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 858.82 | .009 | .700 | 87.0 | 72.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 8[illegible]0.99 | .011 | .700 | 76.0 | 73.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 863.59 | .011 | .750 | 82.0 | 74.0 | 7.5 | 165.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 866.03 | .008 | .700 | 95.0 | 75.0 | 7.5 | 160.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 868.03 | .008 | .600 | 94.0 | 76.0 | 8.0 | 160.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 870.31 | .014 | .750 | 98.0 | 77.0 | 10.0 | 165.0 | | .600 | 450.0 |
| 5 | 1 | 5.00 | 872.79 | .014 | .700 | 100.0 | 78.0 | 14.0 | 165.0 | | .600 | 450.0 |
| 6 | 1 | 5.00 | 875.34 | .011 | .750 | 82.0 | 78.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 878.03 | .011 | .800 | 89.0 | 79.0 | 7.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 880.37 | .006 | .800 | 98.0 | 80.0 | 7.0 | 160.0 | | .500 | 300.0 |
| 6 | 1 | 5.00 | 882.08 | .006 | .550 | 98.0 | 80.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 884.03 | .008 | .550 | 98.0 | 81.0 | 8.0 | 160.0 | 70.0 | .600 | 350.0 |
| 6 | 1 | 5.00 | 886.24 | .008 | .650 | 100.0 | 82.0 | 10.0 | 160.0 | | .600 | 350.0 |
| 7 | 1 | 5.00 | 888.17 | .006 | .550 | 86.0 | 82.0 | 8.0 | 155.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 889.99 | .006 | .450 | 90.0 | 82.0 | 8.0 | 150.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 891.61 | .005 | .400 | 95.0 | 82.0 | 10.0 | 155.0 | 60.0 | .600 | 280.0 |
| 7 | 1 | 5.00 | 893.37 | .005 | .400 | 97.0 | 83.0 | 11.0 | 155.0 | | .600 | 280.0 |
| 7 | 1 | 5.00 | 894.87 | .004 | .300 | 100.0 | 84.0 | 12.0 | 155.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 896.38 | .004 | .300 | 98.0 | 84.0 | 13.0 | 155.0 | | .600 | 250.0 |
| 8 | 1 | 5.00 | 898.77 | .011 | .650 | 82.0 | 81.0 | 6.0 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 901.12 | .011 | .650 | 87.0 | 82.0 | 6.5 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 903.36 | .008 | .550 | 95.0 | 82.0 | 7.0 | 160.0 | | .600 | 350.0 |
| 8 | 1 | 5.00 | 905.49 | .008 | .550 | 96.0 | 82.0 | 7.0 | 160.0 | | .600 | 350.0 |
| 8 | 1 | 5.00 | 907.40 | .007 | .400 | 99.0 | 82.0 | 7.0 | 160.0 | 55.0 | .600 | 320.0 |
| 8 | 1 | 5.00 | 909.35 | .007 | .400 | 99.0 | 82.0 | 7.0 | 160.0 | | .600 | 320.0 |

TABLE A-3

PARTICULATE DATA AND CALCULATED VALUES

RUN- 5 DATE- 12-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H20) | H20 COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.31 | 0.00 | 598.0 | 3178.70 | 9264.70 | .20 | 909.35 | 7.3 | 15.0 | 2.9 | .850 |

| PORT- POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H20) | DELTA H (I.H20) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 911.14 | .006 | .450 | 54.0 | 56.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 912.85 | .006 | .400 | 58.0 | 56.0 | 5.5 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 914.55 | .006 | .400 | 66.0 | 56.0 | 5.5 | 155.0 | 55.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 916.25 | .006 | .350 | 68.0 | 57.0 | 6.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 918.28 | .008 | .550 | 66.0 | 62.0 | 8.0 | 150.0 | | .600 | 350.0 |
| 2 | 1 | 5.00 | 920.33 | .008 | .550 | 72.0 | 62.0 | 10.0 | 150.0 | | .600 | 350.0 |
| 2 | 1 | 5.00 | 922.34 | .008 | .500 | 83.0 | 65.0 | 10.5 | 145.0 | | .600 | 350.0 |
| 2 | 1 | 5.00 | 924.53 | .008 | .600 | 86.0 | 65.0 | 11.0 | 145.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 926.59 | .008 | .550 | 75.0 | 70.0 | 11.0 | 155.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 928.65 | .008 | .500 | 80.0 | 72.0 | 11.0 | 160.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 930.73 | .008 | .500 | 90.0 | 74.0 | 12.0 | 160.0 | 65.0 | .600 | 350.0 |
| 4 | 1 | 5.00 | 932.78 | .008 | .500 | 92.0 | 74.0 | 12.0 | 160.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 934.63 | .006 | .400 | 79.0 | 76.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 936.39 | .006 | .400 | 83.0 | 77.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 938.42 | .008 | .500 | 90.0 | 78.0 | 6.0 | 160.0 | 65.0 | .600 | 350.0 |
| 3 | 1 | 5.00 | 940.55 | .008 | .500 | 93.0 | 79.0 | 6.0 | 160.0 | | .600 | 350.0 |

TABLE A-3 (Concluded)

RUN- 5 DATE- 12-04-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 942.89 | .011 | .700 | 73.0 | 65.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 945.26 | .011 | .700 | 79.0 | 75.0 | 7.5 | 155.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 947.63 | .011 | .650 | 91.0 | 76.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 950.01 | .011 | .650 | 95.0 | 77.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 952.39 | .011 | .700 | 83.0 | 80.0 | 10.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 954.77 | .011 | .650 | 90.0 | 81.0 | 11.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 957.19 | .011 | .700 | 100.0 | 83.0 | 11.5 | 165.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 959.60 | .011 | .700 | 103.0 | 83.0 | 12.0 | 160.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 961.40 | .006 | .500 | 86.0 | 84.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 963.18 | .006 | .400 | 89.0 | 85.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 964.95 | .006 | .350 | 95.0 | 86.0 | 5.5 | 165.0 | 65.0 | .600 | 300.0 |
| 7 | 1 | 5.00 | 966.73 | .006 | .300 | 97.0 | 87.0 | 6.5 | 165.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 969.13 | .011 | .650 | 90.0 | 86.0 | 10.0 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 971.54 | .011 | .650 | 96.0 | 88.0 | 10.5 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 973.93 | .011 | .650 | 104.0 | 88.0 | 11.5 | 160.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 976.43 | .011 | .650 | 108.0 | 90.0 | 12.0 | 160.0 | | .600 | 400.0 |

TABLE A-4

PARTICULATE DATA AND CALCULATED VALUES

RUN- 7 DATE- 12-05-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.25 | 0.00 | 624.7 | 10536.20 | 62150.60 | .20 | 977.30 | 9.2 | 17.2 | 4.1 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 978.81 | .004 | .300 | 64.0 | 66.0 | 4.0 | 155.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 980.18 | .004 | .250 | 68.0 | 67.0 | 4.0 | 155.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 981.61 | .004 | .250 | 72.0 | 67.0 | 4.0 | 150.0 | 60.0 | .600 | 250.0 |
| 1 | 1 | 5.00 | 983.08 | .004 | .250 | 74.0 | 68.0 | 4.0 | 150.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 984.80 | .006 | .350 | 72.0 | 70.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 986.52 | .006 | .300 | 77.0 | 71.0 | 6.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 988.47 | .008 | .400 | 85.0 | 73.0 | 8.0 | 150.0 | 65.0 | .600 | 350.0 |
| 2 | 1 | 5.00 | 990.56 | .008 | .500 | 88.0 | 74.0 | 8.5 | 150.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 992.31 | .006 | .350 | 78.0 | 76.0 | 10.0 | 165.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 994.20 | .006 | .450 | 81.0 | 77.0 | 11.0 | 160.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 995.95 | .006 | .400 | 90.0 | 78.0 | 12.0 | 165.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 997.72 | .006 | .400 | 92.0 | 79.0 | 12.0 | 160.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 999.19 | .004 | .300 | 80.0 | 80.0 | 4.0 | 160.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 1000.66 | .004 | .250 | 82.0 | 80.0 | 5.0 | 160.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 1002.10 | .004 | .250 | 88.0 | 81.0 | 5.0 | 160.0 | 60.0 | .600 | 250.0 |
| 3 | 1 | 5.00 | 1003.49 | .004 | .250 | 90.0 | 82.0 | 6.0 | 160.0 | | .600 | 250.0 |

TABLE A-4 (Concluded)

RUN- 7 DATE- 12-05-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 1005.43 | .008 | .450 | 70.0 | 74.0 | 9.0 | 160.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 1007.39 | .008 | .450 | 74.0 | 74.0 | 10.0 | 165.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 1009.53 | .008 | .550 | 84.0 | 74.0 | 11.0 | 165.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 1011.61 | .008 | .550 | 87.0 | 75.0 | 11.0 | 170.0 | | .600 | 350.0 |
| 6 | 1 | 5.00 | 1013.61 | .008 | .550 | 77.0 | 77.0 | 5.0 | 170.0 | | .600 | 350.0 |
| 6 | 1 | 5.00 | 1015.64 | .008 | .500 | 83.0 | 78.0 | 9.0 | 165.0 | | .600 | 350.0 |
| 6 | 1 | 5.00 | 1017.64 | .007 | .450 | 92.0 | 79.0 | 10.0 | 160.0 | | .600 | 325.0 |
| 6 | 1 | 5.00 | 1019.41 | .007 | .350 | 94.0 | 80.0 | 9.0 | 165.0 | | .600 | 325.0 |
| 7 | 1 | 5.00 | 1021.70 | .010 | .700 | 84.0 | 80.0 | 12.0 | 195.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 1023.97 | .010 | .700 | 92.0 | 82.0 | 12.0 | 195.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 1026.25 | .010 | .650 | 98.0 | 83.0 | 12.0 | 190.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 1028.50 | .010 | .650 | 103.0 | 84.0 | 12.5 | 185.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 1029.96 | .004 | .400 | 80.0 | 80.0 | 5.0 | 180.0 | | .600 | 250.0 |
| 8 | 1 | 5.00 | 1031.42 | .004 | .400 | 81.0 | 81.0 | 9.0 | 175.0 | | .600 | 250.0 |
| 8 | 1 | 5.00 | 1032.96 | .005 | .300 | 86.0 | 82.0 | 9.0 | 175.0 | | .600 | 275.0 |
| 8 | 1 | 5.00 | 1034.54 | .005 | .300 | 89.0 | 81.0 | 9.0 | 175.0 | | .600 | 275.0 |

TABLE A-5

PARTICULATE DATA AND CALCULATED VALUES

RUN- 4 DATE- 12-06-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H20) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 316.4 | 3719.50 | 9569.10 | .20 | 34.54 | 5.4 | 16.1 | 1.5 | .850 |

| POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H20) | DELTA H (I.H20) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VFI (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 5.00 | 36.12 | .006 | .300 | 40.0 | 40.0 | 4.0 | 155.0 | | .600 | 300.0 |
| A | 1 | 5.00 | 37.68 | .006 | .350 | 43.0 | 41.0 | 5.0 | 160.0 | | .600 | 300.0 |
| A | 1 | 5.00 | 39.44 | .005 | .400 | 49.0 | 42.0 | 6.5 | 160.0 | | .600 | 300.0 |
| B | 1 | 5.00 | 41.12 | .006 | .400 | 48.0 | 45.0 | 8.0 | 145.0 | | .600 | 300.0 |
| B | 1 | 5.00 | 42.73 | .006 | .400 | 51.0 | 46.0 | 8.0 | 145.0 | | .600 | 300.0 |
| B | 1 | 5.00 | 44.51 | .006 | .400 | 57.0 | 47.0 | 9.0 | 145.0 | | .600 | 300.0 |
| C | 1 | 5.00 | 46.19 | .006 | .400 | 51.0 | 50.0 | 9.0 | 150.0 | | .600 | 300.0 |
| C | 1 | 5.00 | 47.87 | .006 | .400 | 55.0 | 50.0 | 9.5 | 155.0 | | .600 | 300.0 |
| C | 1 | 5.00 | 49.55 | .006 | .350 | 60.0 | 51.0 | 10.0 | 155.0 | | .600 | 300.0 |
| D | 1 | 5.00 | 50.96 | .004 | .250 | 54.0 | 52.0 | 10.0 | 150.0 | | .600 | 250.0 |
| D | 1 | 5.00 | 52.36 | .004 | .250 | 58.0 | 52.0 | 10.5 | 155.0 | | .600 | 250.0 |
| D | 1 | 5.00 | 53.76 | .004 | .250 | 60.0 | 53.0 | 11.0 | 155.0 | | .600 | 250.0 |

TABLE A-5 (Concluded)

RUN- 4 DATE- 12-06-75

| PORT- | POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H20) | DELTA H (I.H20) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GFL TEMP (D.F) | PROBE T DIA (IN) | VFI (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 1 | 5.00 | 55.53 | .006 | .400 | 55.0 | 54.0 | 4.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 57.10 | .006 | .350 | 59.0 | 55.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 58.69 | .006 | .300 | 63.0 | 55.0 | 7.5 | 165.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 60.44 | .006 | .400 | 54.0 | 55.0 | 13.0 | 165.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 62.05 | .006 | .350 | 58.0 | 56.0 | 13.0 | 170.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 63.70 | .006 | .350 | 63.0 | 56.0 | 12.0 | 170.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 65.39 | .006 | .350 | 60.0 | 56.0 | 11.0 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 67.09 | .006 | .350 | 64.0 | 56.0 | 12.5 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 68.72 | .006 | .350 | 68.0 | 58.0 | 13.0 | 160.0 | | .600 | 300.0 |

TABLE A-6

## PARTICULATE DATA AND CALCULATED VALUES

RUN- 11 DATE- 12-07-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 370.0 | 6043.60 | 12969.50 | .20 | 70.83 | 5.1 | 18.2 | 5.5 | .850 |

| PORT- | POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 72.13 | .004 | .250 | 44.0 | 45.0 | 3.0 | 170.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 73.50 | .004 | .250 | 47.0 | 45.0 | 4.0 | 170.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 74.86 | .004 | .250 | 51.0 | 45.0 | 6.0 | 170.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 76.66 | .008 | .400 | 48.0 | 46.0 | 9.0 | 200.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 78.44 | .006 | .400 | 53.0 | 47.0 | 9.0 | 200.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 80.25 | .008 | .400 | 59.0 | 47.0 | 9.5 | 205.0 | 56.0 | .600 | 350.0 |
| 3 | 1 | 5.00 | 81.87 | .006 | .300 | 52.0 | 48.0 | 9.5 | 170.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 83.43 | .006 | .300 | 58.0 | 49.0 | 11.0 | 180.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 84.83 | .006 | .300 | 62.0 | 50.0 | 13.5 | 160.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 86.49 | .006 | .350 | 52.0 | 50.0 | 3.0 | 170.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 88.34 | .006 | .400 | 57.0 | 51.0 | 3.0 | 185.0 | 50.0 | .600 | 300.0 |
| 5 | 1 | 5.00 | 90.09 | .006 | .400 | 63.0 | 51.0 | 4.0 | 190.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 91.69 | .006 | .400 | 55.0 | 52.0 | 4.0 | 175.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 93.32 | .006 | .350 | 59.0 | 53.0 | 4.0 | 180.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 94.94 | .006 | .150 | 65.0 | 54.0 | 5.0 | 190.0 | | .600 | 300.0 |

TABLE A-6 (Concluded)

RUN- 11 DATE- 12-07-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 1 | 5.00 | 96.57 | .006 | .150 | 53.0 | 54.0 | 5.0 | 185.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 98.16 | .006 | .150 | 57.0 | 55.0 | 6.0 | 195.0 | 55.0 | .600 | 300.0 |
| 7 | 1 | 5.00 | 99.72 | .006 | .100 | 61.0 | 55.0 | 6.0 | 190.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 101.28 | .006 | .300 | 59.0 | 55.0 | 7.0 | 205.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 102.85 | .006 | .300 | 62.0 | 56.0 | 8.0 | 205.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 104.42 | .006 | .300 | 65.0 | 57.0 | 8.0 | 205.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 105.74 | .005 | .250 | 60.0 | 58.0 | 7.0 | 335.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 107.04 | .005 | .200 | 62.0 | 58.0 | 7.0 | 330.0 | 60.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 108.36 | .005 | .200 | 66.0 | 58.0 | 8.0 | 330.0 | | .600 | 300.0 |

TABLE A-7

## PARTICULATE DATA AND CALCULATED VALUES

RUN- 13 DATE- 12-08-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.35 | 0.00 | 52.5 | 1577.80 | 2566.30 | .20 | 111.14 | 1.1 | 22.3 | 6.7 | .850 |

| PORT- | POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 112.45 | .005 | .250 | 42.0 | 45.0 | 9.0 | 320.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 113.52 | .005 | .200 | 45.0 | 45.0 | 14.0 | 325.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 115.01 | .005 | .300 | 50.0 | 45.0 | 5.0 | 290.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 116.04 | .003 | .100 | 42.0 | 44.0 | 10.0 | 320.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 116.76 | .003 | .050 | 45.0 | 45.0 | 15.0 | 330.0 | | .600 | 250.0 |

TABLE A-5

## PARTICULATE DATA AND CALCULATED VALUES

RUN- 14 DATE- 12-08-75

| ATMOS TEMP (DEG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.35 | 0.00 | 176.0 | 6858.70 | 10048.90 | .20 | 116.76 | 1.1 | 22.3 | 6.7 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 118.09 | .005 | .200 | 43.0 | 45.0 | 2.5 | 325.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 119.36 | .005 | .200 | 46.0 | 46.0 | 5.0 | 320.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 120.21 | .002 | .100 | 46.0 | 46.0 | 7.0 | 325.0 | | .600 | 200.0 |
| 2 | 1 | 5.00 | 120.98 | .002 | .100 | 47.0 | 47.0 | 12.0 | 330.0 | | .600 | 200.0 |
| 4 | 1 | 5.00 | 122.15 | .003 | .200 | 50.0 | 48.0 | 4.0 | 235.0 | | .600 | 220.0 |
| 4 | 1 | 5.00 | 123.22 | .003 | .200 | 53.0 | 48.0 | 10.0 | 245.0 | 50.0 | .600 | 220.0 |
| 3 | 1 | 5.00 | 124.27 | .003 | .200 | 45.0 | 47.0 | 4.0 | 200.0 | | .600 | 200.0 |
| 3 | 1 | 5.00 | 125.27 | .002 | .150 | 47.0 | 47.0 | 11.0 | 215.0 | | .600 | 200.0 |
| 5 | 1 | 5.00 | 126.59 | .006 | .250 | 46.0 | 47.0 | 8.0 | 335.0 | | .600 | 340.0 |
| 5 | 1 | 5.00 | 127.71 | .005 | .150 | 48.0 | 47.0 | 8.0 | 335.0 | 50.0 | .600 | 340.0 |
| 6 | 1 | 5.00 | 129.27 | .004 | .300 | 49.0 | 47.0 | 4.0 | 295.0 | | .600 | 280.0 |
| 6 | 1 | 5.00 | 130.65 | .004 | .300 | 54.0 | 48.0 | 9.0 | 325.0 | | .600 | 280.0 |
| 7 | 1 | 5.00 | 132.00 | .004 | .300 | 52.0 | 49.0 | 1.0 | 300.0 | | .600 | 280.0 |
| 7 | 1 | 5.00 | 133.17 | .004 | .250 | 55.0 | 50.0 | 2.0 | 325.0 | | .600 | 280.0 |

TABLE A-9

## PARTICULATE EMISSION DATA

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| DN | PROBE TIP DIAMETER | IN. | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 30.0 | 240.0 | 1[illegible]0.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.28 | 29.31 | 29.31 |
| DH | AVG ORIFICE PRES DROP | IN.H2O | .442 | .505 | .5[illegible] |
| VM | VOL DRY GAS-METER COND | DCF | 11.35 | 96.34 | 67.[illegible] |
| TM | AVG GAS METER TEMP | DEG.F | 85.[illegible] | 75.5 | 79.[illegible] |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.15 | 93.53 | 64.61 |
| VA | TOTAL H2O COLLECTED | ML | 31.[illegible] | 675.2 | [illegible] |
| VWS | VOL H2O VAPOR-STD COND | SCF | 1.47 | 32.00 | 20.39 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| MD | MOLE FRACTION DRY GAS | | .884 | .745 | .695 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 11.0 | 15.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 9.2 | 7.3 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 1.9 | 2.4 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 77.9 | 74.[illegible] |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.13 | 30.[illegible] |
| MW | MOLECULAR WT-STK GAS | | 28.72 | 27.[illegible] | 28.82 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .007 | .008 | .008 |
| TS | AVG STACK TEMPERATURE | DEG.F | 52.0 | 150.5 | 15[illegible].3 |
| NP | NET SAMPLING POINTS | | [illegible] | [illegible] | 3[illegible] |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.28 | 29.31 | 29.31 |
| VS | AVG STACK GAS VELOCITY | FPM | 275 | 332 | 3[illegible]3 |
| AS | STACK AREA | IN2 | 11,310[a/] | 29 | 2[illegible] |
| QS | STK FLOWRATE, DRY,STD CO | DSCFM | 19,[illegible]26[a/] | 42 | 4[illegible] |
| QA | ACTUAL STACK FLOWRATE | ACFM | 21,001[a/] | 66 | 7[illegible] |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.[illegible] | 99.[illegible] |
| MF | PARTICULATE WT-PARTIAL | MG | 786.70 | 2162.[illegible]0 | 3178.70 |
| MT | PARTICULATE WT-TOTAL | MG | 955.70 | [illegible]855.10 | 9264.70 |
| IC | PERC IMPINGER CATCH | | 17.68 | 55.[illegible]6 | 65.[illegible] |
| CAP | PART. LOAD-PTL,STD CN | GR/DSCF | 1.08703 | .35606 | .75764 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 1.32054 | .79940 | 2.20837 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | .47224 | .22560 | .44224 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 1.18110 | .50651 | 1.28[illegible]5 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | 180 | .1[illegible][b/] | .[illegible][b/] |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 219 | .[illegible][b/] | .[illegible][b/] |
| EA | PERCENT EXCESS AIR | | 67 | 67 | 4[illegible] |

a/ Nominal 10-ft (120 in.) diameter stack.

b/ Per stack; to obtain total for kiln, multiply by 8.

TABLE A-9 (Continued)

PARTICULATE EMISSION DATA

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 160.0 | 105.0 | 120.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.25 | 29.65 | 29.65 |
| DH | AVG ORIFICE PRES DROP | IN.H2O | .412 | .359 | .319 |
| VM | VOL DRY GAS-METER COND | DCF | 57.24 | 34.18 | 37.53 |
| TM | AVG GAS METER TEMP | DEG.F | 79.6 | 53.3 | 54.4 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 55.00 | 35.00 | 35.35 |
| VA | TOTAL H2O COLLECTED | ML | 624.7 | 316.4 | 378.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 29.61 | 15.00 | 17.54 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| MD | MOLE FRACTION DRY GAS | | .650 | .700 | .686 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 17.2 | 16.1 | 16.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 6.4 | 5.1 |
| PCO | PERCENT CO BY VOL, DRY | | 4.1 | 1.5 | 5.5 |
| PN2 | PERCENT N2 BY VOL, DRY | | 69.5 | 76.0 | 71.2 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 30.83 | 31.12 |
| MW | MOLECULAR WT-STK GAS | | 26.53 | 26.98 | 27.00 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .005 | .006 |
| TS | AVG STACK TEMPERATURE | DEG.F | 154.8 | 157.1 | 202.7 |
| NP | NET SAMPLING POINTS | | 32 | 24 | 24 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.25 | 29.65 | 29.65 |
| VS | AVG STACK GAS VELOCITY | FPM | 309 | 293 | 300 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 33 | 35 | 33 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 62 | 59 | 61 |
| PEPI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.6 |
| MF | PARTICULATE WT-PARTIAL | MG | 10536.20 | 3719.50 | 6043.60 |
| MT | PARTICULATE WT-TOTAL | MG | 62150.60 | 8569.10 | 12969.50 |
| IC | PERC IMPINGER CATCH | | 83.05 | 56.59 | 53.41 |
| CAP | PART. LOAD-PTL,STD CN | GR/DSCF | 2.95024 | 1.63650 | 2.42671 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 17.40280 | 3.77023 | 5.20770 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 1.59022 | .97498 | 1.31975 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 9.38035 | 2.24620 | 2.83217 |
| CAV | PARTIC EMIS-PARTIAL | LB/HR | .84[a] | .40[b] | .68[a] |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 4.98[a] | 1.13[b] | 1.46[a] |
| EA | PERCENT EXCESS AIR | | 54 | 34 | 14 |

a/ Per stack; to obtain total for kiln, multiply by 8.

b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE A-9 (Concluded)

## PARTICULATE EMISSION DATA

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 25.0 | 70.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.35 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .180 | .207 |
| VM | VOL DRY GAS-METER COND | DCF | 5.62 | 16.41 |
| TM | AVG GAS METER TEMP | DEG.F | 44.8 | 46.0 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 5.79 | 16.80 |
| VW | TOTAL H2O COLLECTED | ML | 52.5 | 176.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 2.49 | 8.34 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| MD | MOLE FRACTION DRY GAS | | .699 | .668 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 22.3 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 1.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 6.7 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 69.9 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.61 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.52 | 27.10 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .004 | .004 |
| TS | AVG STACK TEMPERATURE | DEG.F | 317.0 | 293.6 |
| NP | NET SAMPLING POINTS | | 5 | 14 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.35 | 29.35 |
| VS | AVG STACK GAS VELOCITY | FPM | 280 | 260 |
| AS | STACK AREA | IN2 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 26 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 56 | 52 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| MF | PARTICULATE WT-PARTIAL | MG | 1577.80 | 6858.70 |
| MT | PARTICULATE WT-TOTAL | MG | 2566.30 | 10048.90 |
| IC | PERC IMPINGER CATCH | | 38.52 | 31.75 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 4.19602 | 6.28550 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 6.82485 | 9.20908 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 1.96373 | 2.89786 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 3.19402 | 4.24575 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | .94[a] | 1.20[b] |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 1.53[a] | 1.80[b] |
| EA | PERCENT EXCESS AIR | | -11 | -11 |

[a] Per stack; to obtain total multiply by 1.67.

[b] Per stack; to obtain total for kiln, multiply by 2.

TABLE A-10

## PARTICULATE EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 30.0 | 240.0 | 150.0 |
| PR | BAROMETRIC PRESSURE | IN.HG | 29.26 | 29.31 | 29.31 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .442 | .506 | .539 |
| VM | VOL DRY GAS-METER COND | DCF | 11.35 | 96.34 | 67.08 |
| TM | AVG GAS METER TEMP | DEG.F | 68.4 | 75.5 | 79.8 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .32 | 2.65 | 1.83 |
| VW | TOTAL H2O COLLECTED | ML | 31.0 | 675.2 | 508.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .04 | .91 | .80 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| MD | MOLE FRACTION DRY GAS | | .884 | .745 | .695 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 11.0 | 15.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 9.2 | 7.3 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 1.9 | 2.9 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 77.9 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.13 | 30.69 |
| MW | MOLECULAR WT-STK GAS | | 28.72 | 27.04 | 26.82 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .007 | .008 | .008 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 11.1 | 65.8 | 70.1 |
| NP | NET SAMPLING POINTS | | 6 | 48 | 32 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.26 | 29.31 | 29.31 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 83.8 | 101.2 | 107.7 |
| AS | STACK AREA | M2 | 11.310[a] | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 547[a] | 1.2 | 1.2 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 612[a] | 1.9 | 2.0 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| MF | PARTICULATE WT-PARTIAL | MG | 786.70 | 2162.50 | 3178.70 |
| MT | PARTICULATE WT-TOTAL | MG | 955.70 | 4855.10 | 9264.70 |
| IC | PERC IMPINGER CATCH | | 17.68 | 55.46 | 65.69 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 2487.49 | 814.79 | 1733.85 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 3021.85 | 1829.31 | 5053.51 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 2224.82 | 516.25 | 1011.99 |
| CAOM | PART. LOAD-TTL,STK CN | MG/M3 | 2702.75 | 1159.06 | 2949.56 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | 82 | .058[b] | .121[b] |
| CAOM | PARTIC EMIS-TOTAL | KG/HR | 99 | .131[b] | .354[b] |
| EA | PERCENT EXCESS AIR | | 57 | 57 | 57 |

[a] Nominal 10-ft (120 in.) diameter stack.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE A-10 (Continued)

## PARTICULATE EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 160.0 | 105.0 | 120.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.25 | 29.65 | 29.65 |
| P1 | AVG ORIFICE PRES DROP | IN.H2O | .412 | .350 | .319 |
| VM | VOL DRY GAS-METER COND | DCF | 57.24 | 34.18 | 37.53 |
| TM | AVG GAS METER TEMP | DEG.F | 79.8 | 53.3 | 54.4 |
| VMSTM | VOL DRY GAS-STD COND | NCM | 1.56 | .99 | 1.09 |
| VW | TOTAL H2O COLLECTED | ML | 624.7 | 316.4 | 370.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .84 | .42 | .50 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| MD | MOLE FRACTION DRY GAS | | .650 | .700 | .686 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 17.2 | 16.1 | 18.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 6.4 | 5.1 |
| PCO | PERCENT CO BY VOL, DRY | | 4.1 | 1.5 | 5.5 |
| PN2 | PERCENT N2 BY VOL, DRY | | 69.5 | 76.0 | 71.2 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 30.83 | 31.12 |
| MW | MOLECULAR WT-STK GAS | | 26.53 | 26.98 | 27.00 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .006 | .006 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 71.8 | 69.5 | 94.8 |
| NP | NET SAMPLING POINTS | | 32 | 21 | 24 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.25 | 29.65 | 29.65 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 94.3 | 89.3 | 91.5 |
| AS | STACK AREA | M2 | 29 | 29 | 29 |
| QSD | STK FLOWRATE, DRY,STD CN | NM3/MIN | .9 | 1.0 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.8 | 1.7 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| MP | PARTICULATE WT-PARTIAL | MG | 10536.20 | 3717.50 | 6043.60 |
| MT | PARTICULATE WT-TOTAL | MG | 62150.60 | 8569.10 | 12969.50 |
| IC | PERC ISOKINETIC CATCH | | 94.05 | 56.59 | 53.40 |
| CAPM | PART. LOAD-PTL,STD CN | MG/NM3 | 6751.16 | 3744.88 | 5553.14 |
| CATM | PART. LOAD-TTL,STD CN | MG/NM3 | 39823.53 | 8627.56 | 11916.98 |
| CAPM | PART. LOAD-PTL,STK CN | MG/M3 | 3838.97 | 2231.09 | 3020.04 |
| CATM | PART. LOAD-TTL,STK CN | MG/M3 | 21465.44 | 5140.06 | 6480.97 |
| CAPM | PARTIC EMIS-PARTIAL | KG/HR | .183[a/] | .222[b/] | .308[a/] |
| CATM | PARTIC EMIS-TOTAL | KG/HR | 2.257[a/] | .512[b/] | .661[a/] |
| EA | PERCENT EXCESS AIR | | 64 | 59 | 14 |

a/ Per stack; to obtain total for kiln, multiply by 8.

b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE A-10 (Concluded)

## PARTICULATE EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 25.0 | 70.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.35 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .180 | .207 |
| VM | VOL DRY GAS-METER COND | DCF | 5.62 | 16.41 |
| TM | AVG GAS METER TEMP | DEG.F | 44.8 | 48.0 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .16 | .48 |
| VW | TOTAL H2O COLLECTED | ML | 52.5 | 176.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .07 | .24 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| MD | MOLE FRACTION DRY GAS | | .699 | .668 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 22.3 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 1.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 6.7 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 69.9 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.61 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.52 | 27.10 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .004 | .004 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 158.3 | 145.3 |
| NP | NET SAMPLING POINTS | | 5 | 14 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.35 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 85.4 | 79.3 |
| AS | STACK AREA | IN2 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .7 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.5 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| MF | PARTICULATE WT-PARTIAL | MG | 1577.80 | 6858.70 |
| MT | PARTICULATE WT-TOTAL | MG | 2566.30 | 10048.90 |
| IC | PERC IMPINGER CATCH | | 38.52 | 31.75 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 9601.92 | 14383.35 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 15617.58 | 21073.51 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 4493.69 | 6631.29 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 7309.01 | 9715.72 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | .428[a] | .586[b] |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | .695[a] | .858[b] |
| EA | PERCENT EXCESS AIR | | -11 | -11 |

a/ Per stack; to obtain total, multiply by 1.67.

b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE A-11

SUMMARY OF RESULTS (PARTICULATE)

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.15 | 93.53 | 64.61 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| TS | AVG STACK TEMPERATURE | DEG.F | 52.0 | 150.5 | 154.3 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 11.31[a] | 42 | 41 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 21.60[a] | 66 | 71 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 786.70 | 2162.50 | 3178.70 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 1.08703 | .35606 | .75769 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | .47224 | .22560 | .44224 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | 180 | .13[b] | .27[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 955.70 | 4855.10 | 9264.70 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 1.32054 | .79940 | 2.20837 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 1.18110 | .50651 | 1.28895 |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 214 | .29[b] | .78[b] |
| IC | PERC IMPINGER CATCH | | 17.68 | 55.46 | 65.69 |

a/ Based on nominal 10-ft (120 in.) diameter stack.

b/ Per stack; to obtain total for kiln, multiply by 8.

TABLE A-11 (Continued)

SUMMARY OF RESULTS (PARTICULATE)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 55.00 | 35.00 | 38.35 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| TS | AVG STACK TEMPERATURE | DEG.F | 164.8 | 157.1 | 202.7 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 33 | 35 | 33 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 62 | 59 | 60 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 10536.20 | 3719.50 | 6043.60 |
| CAN | PART. LOAD-PTL,STD CN | GM/DSCF | 2.45024 | 1.63650 | 2.42671 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 1.59022 | .97498 | 1.31975 |
| EAF | PARTIC EMIS-PARTIAL | LB/HR | .54[a]/ | .[illegible][b]/ | .66[a]/ |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 62150.60 | 4569.10 | 12969.50 |
| CAD | PART. LOAD-TTL,STD CN | GR/DSCF | 17.40280 | 3.77023 | 5.20770 |
| CAT | PART. LOAD-TTL,STK CN | GR/ACF | 9.38035 | 2.24620 | 2.83217 |
| EAF | PARTIC EMIS-TOTAL | LB/HR | 4.96[a]/ | 1.1[b]/ | 1.4[a]/ |
| IC | PERC [illegible] CATCH | | 83.05 | 56.59 | 53.40 |

a/ For stacks to obtain total for kiln, multiply by 8.
b/ For stacks to obtain total for kiln, multiply by 7.

TABLE V-II (Concluded)

SUMMARY OF RESULTS (PARTICULATE)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 5.79 | 16.80 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| TS | AVG STACK TEMPERATURE | DEG.F | 317.0 | 293.6 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 26 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 56 | 52 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 1577.80 | 6858.70 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 4.19602 | 6.28550 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 1.96373 | 2.89788 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | .[illegible]/ | 1.[illegible]/ |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 2566.30 | 10048.90 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 6.82485 | 9.20908 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 3.19402 | 4.24575 |
| CAR | PARTIC EMIS-TOTAL | LB/HR | 1.[illegible]/ | 1.[illegible]/ |
| IC | PERC IMPINGER CATCH | | 38.52 | 31.75 |

a/ For stack to obtain total, multiply by 1.67.

b/ For stack to obtain total for kiln, multiply by 7.

TABLE A-12

SUMMARY OF RESULTS--METRIC UNITS (PARTICULATE)

| PARM | DESCRIPTION | UNITS | 1 | 4 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .316 | 2.649 | 1.829 |
| PMST | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 11.1 | 65.8 | 70.1 |
| QSM | STP FLOWRATE, DRY,STD CN | NM3/MIN | .347[a] | 1.2 | 1.2 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | .612[a] | 1.9 | 2.0 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| FA | PERCENT EXCESS AIR | | 67 | 67 | 67 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 786.70 | 2162.50 | 3178.70 |
| CAMM | PART. LOAD-PTL,STD CN | MG/NM3 | 2487.49 | 814.79 | 1733.85 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 2224.92 | 516.25 | 1011.99 |
| CAMM | PARTIC EMIS-PARTIAL | KG/HR | .52 | .058[b] | .121[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 955.70 | 4855.10 | 9264.70 |
| CAUM | PART. LOAD-TTL,STD CN | MG/NM3 | 3021.85 | 1829.31 | 5053.51 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 2702.75 | 1159.06 | 2949.55 |
| CAMM | PARTIC EMIS-TOTAL | KG/HR | .63 | .131[b] | .354[b] |
| IC | PERC IMPINGER CATCH | | 17.68 | 55.46 | 65.69 |

[a] Nominal 1-ft (12-in.) diameter stack.

[b] For stacks to obtain total for kiln, multiply by 4.

TABLE A-12 (Continued)

SUMMARY OF RESULTS--METRIC UNITS (PARTICULATE)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | 1.557 | .991 | 1.086 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 73.8 | 69.5 | 94.8 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .9 | 1.0 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.8 | 1.7 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| EA | PERCENT EXCESS AIR | | 64 | 39 | 14 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 10536.20 | 3719.50 | 6043.60 |
| CAOM | PART. LOAD-PTL,STD CN | MG/NM3 | 6751.16 | 3744.88 | 5553.14 |
| CAIM | PART. LOAD-PTL,STK CN | MG/M3 | 3638.97 | 2231.09 | 3020.04 |
| CAMM | PARTIC EMIS-PARTIAL | KG/HR | .381[a] | .223[b] | .[illegible][a] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 62150.60 | 8569.10 | 12969.50 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 39823.53 | 8627.56 | 11916.98 |
| CAIM | PART. LOAD-TTL,STK CN | MG/M3 | 21465.44 | 5140.06 | 6480.47 |
| CAMM | PARTIC EMIS-TOTAL | KG/HR | 2.257[a] | .513[b] | .661[a] |
| IC | PERC IMPINGER CATCH | | 83.05 | 56.59 | 53.40 |

[a] Per stack; to obtain total for kiln, multiply by 8.
[b] Per stack; to obtain total for kiln, multiply by 7.

TABLE A-12 (Concluded)

SUMMARY OF RESULTS--METRIC UNITS (PARTICULATE)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .164 | .476 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 158.3 | 145.3 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .7 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.5 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| EA | PERCENT EXCESS AIR | | -11 | -11 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 1577.80 | 6858.70 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 9601.92 | 14383.35 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 4493.69 | 6631.29 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | .428[a] | .586[b] |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 2566.30 | 10048.90 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 15617.58 | 21073.51 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 7309.01 | 9715.72 |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | .695[a] | .858[b] |
| IC | PERC IMPINGER CATCH | | 38.52 | 31.75 |

a/ Per stack; to obtain total, multiply by 1.67.

b/ Per stack; to obtain total for kiln, multiply by 7.

APPENDIX B

SAMPLE CALCULATIONS

## EXAMPLE PARTICULATE CALCULATIONS

1. VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS (1)

$$VMSTD = \frac{17.71 * VM * (PB + PM/13.6)}{TM + 460.}$$

$$= \frac{17.71 * 57.24 * (29.25 + .412/13.6)}{79.8 + 460.} = 55.00 \text{ DSCF}$$

VMSTM = VMSTD*0.028317 = 55.00*0.028317 = 1.56 DNM3

2. VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWV = 0.0474*VW = 0.0474* 624.7 = 29.61 SCF

VWM = VWV*0.028317 = 29.611*0.028317 = .8385 NM3

3. PERCENT MOISTURE IN STACK GAS

$$PMOS = \frac{100. * VWV}{VMSTD + VWV} = \frac{100. * 29.61}{55.00 + 29.61} = 35.0 \text{ PERCENT}$$

4. MOLE FRACTION OF DRY STACK GAS

$$MD = \frac{100.-PMOS}{100.} = \frac{100.-35.0}{100.} = .650$$

5. AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

$$MWD = (PCO2 * 44/100) + (PO2 * 32/100) + (PN2+PCO * 28/100)$$

$$= (17.2 * 44/100) + (9.2 * 32/100) + (73.6 * 28/100) = 31.12$$

6. MOLECULAR WEIGHT OF STACK GAS

$$MW = MWD*MD + 18*(1-MD)$$

$$= 31.1* .650 + 18*(1- .650) = 26.53$$

7. STACK GAS VELOCITY AT STACK CONDITIONS

$$VS = 5129 * CP * ASQRT(DPS * (TS+460)) * SQRT(1/(PS * MW))$$

$$= 5129 * .850 * 1.977 * SQRT(1/(29.25 * 26.53)) = 309 \text{ FPM}$$

$$VSM = VS * 0.3048 = 309 * 0.3048 = 94 \text{ METERS/MIN}$$

8. STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS, DRY BASIS (1)

$$QS = \frac{0.123 * VS * AS * MD * PS}{TS+460}$$

$$= \frac{0.123 * 309 * 29 * .650 * 29.25}{164.8 + 460} = 33 \text{ DSCFM}$$

$$QSM = QS * 0.028317 = 33 * 0.028317 = 1 \text{ NM3/MIN}$$

9. STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

$$QA = \frac{QS * (TS+460)}{17.71 * PS * MD}$$

$$= \frac{33 * (164.8+460)}{17.71 * 29.25 * .650} = 62 \text{ ACFM}$$

$$QAM = QA * 0.028317 = 62 * 0.028317 = 2 \text{ NM3/MIN}$$

13. PARTICULATE LOADING -- PROBE, CYCLONE, AND FILTER
(AT STACK CONDITIONS)

$$CAT = \frac{17.71 * CAN * PS * MD}{TS * 460}$$

$$= \frac{17.71 * 2.2390 * 29.25 * .650}{164.8 * 460} = 1.20683 \text{ GR/ACF}$$

$$CATM = CAT * 2288.34 = 1.20683 * 2288.34 = 2761.64 \text{ MG/M3}$$

14. PARTICULATE LOADING -- TOTAL
(AT STACK CONDITIONS)

$$CAU = \frac{17.71 * CAO * PS * MD}{TS * 460}$$

$$= \frac{17.71 * 13.4518 * 29.25 * .650}{164.8 * 460} = 7.25071 \text{ GR/ACF}$$

$$CAUM = CAU * 2288.34 = 7.25071 * 2288.34 = 16592.09 \text{ MG/M3}$$

15. PARTICULATE EMISSION RATE
-- PROBE, CYCLONE, AND FILTER

$$CAW = 0.00857 * CAN * QS$$

$$= 0.00857 * 2.2390 * 33 = .64 \text{ LB/HR}$$

$$CAWM = CAW * 0.45359 = .64 * 0.45359 = .29 \text{ KG/HR}$$

16. PARTICULATE EMISSION RATE
-- TOTAL

CAX = 0.00857*CA0*QS

= 0.00857* 13.4518* 33 = 3.85 LB/HR

CAX4 = CAX*0.45359 = 3.85*0.45359 = 1.74 KG/HR

17. PERCENT EXCESS AIR AT SAMPLING POINT

$$EA = \frac{100. * (PO2-0.5*PCO)}{0.264*PN2-PO2+0.5*PCO}$$

$$= \frac{100. *( 9.2-0.5* 4.1)}{0.264*69.5- 9.2+0.5* 4.1} = 63.9 \text{ PERCENT}$$

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(1) STANDARD CONDITIONS- AT 70 DEG F (21.1 DEG C), 29.92 IN HG (760 MM HG)

APPENDIX C

RESULTS OF ANALYSIS - COMPUTER COMPUTATIONS
(TOTAL ORGANIC)

TABLE C-1

ORGANIC DATA AND CALCULATED VALUES

RUN- 1 DATE- 12-02-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 60.0 | 29.26 | 0.00 | 31.0 | 554.90 | 646.70 | | 801.61 | 9.2 | 11.0 | 1.9 | .850 |

| PORT-POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL. (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.00 | 802.84 | .002 | .150 | 62.0 | 62.0 | 1.0 | 62.0 | | .600 | 150.0 |
| D | 5.00 | 804.15 | .008 | .250 | 64.0 | 64.0 | 1.0 | 50.0 | | .600 | 300.0 |
| D | 5.00 | 806.04 | .008 | .400 | 67.0 | 64.0 | 2.0 | 50.0 | | .600 | 300.0 |
| D | 5.00 | 808.02 | .008 | .450 | 72.0 | 64.0 | 2.5 | 50.0 | | .600 | 300.0 |
| D | 5.00 | 810.29 | .008 | .550 | 80.0 | 68.0 | 4.0 | 50.0 | | .600 | 300.0 |
| D | 5.00 | 812.96 | .008 | .850 | 85.0 | 69.0 | 5.5 | 50.0 | | .600 | 300.0 |

TABLE C-2

ORGANIC DATA AND CALCULATED VALUES

RUN- 3 DATE- 12-03-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.31 | 0.00 | 675.2 | 1574.60 | 3367.30 | .20 | 813.01 | 9.2 | 11.0 | 1.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 814.74 | .006 | .400 | 42.0 | 44.0 | 2.5 | 145.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 816.47 | .006 | .350 | 46.0 | 44.0 | 2.5 | 140.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 818.17 | .006 | .330 | 56.0 | 44.0 | 3.0 | 140.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 819.87 | .006 | .350 | 59.0 | 45.0 | 4.0 | 140.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 821.61 | .006 | .370 | 66.0 | 48.0 | 7.0 | 140.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 823.47 | .006 | .400 | 69.0 | 49.0 | 7.5 | 140.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 825.05 | .006 | .300 | 56.0 | 55.0 | 11.0 | 150.0 | 50.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 826.78 | .006 | .400 | 61.0 | 56.0 | 14.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 828.66 | .006 | .440 | 72.0 | 58.0 | 14.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 830.53 | .006 | .400 | 64.0 | 59.0 | 4.0 | 145.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 832.47 | .006 | .350 | 72.0 | 60.0 | 9.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 834.18 | .006 | .350 | 74.0 | 61.0 | 9.0 | 150.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 836.32 | .009 | .550 | 65.0 | 62.0 | 10.0 | 130.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 838.47 | .009 | .530 | 71.0 | 63.0 | 6.5 | 130.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 840.48 | .007 | .450 | 79.0 | 64.0 | 6.5 | 135.0 | | .600 | 320.0 |

TABLE C-2 (Continued)

RUN- 3 DATE- 12-03-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 5.00 | 842.42 | .007 | .400 | 80.0 | 65.0 | 6.5 | 135.0 | | .600 | 320.0 |
| 4 | 1 | 5.00 | 844.38 | .009 | .500 | 85.0 | 66.0 | 8.0 | 130.0 | 50.0 | .600 | 350.0 |
| 4 | 1 | 5.00 | 846.64 | .009 | .550 | 87.0 | 68.0 | 9.0 | 135.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 848.58 | .006 | .500 | 65.0 | 66.0 | 11.0 | 145.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 850.39 | .006 | .400 | 70.0 | 66.0 | 11.0 | 145.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 852.26 | .008 | .450 | 80.0 | 67.0 | 14.0 | 145.0 | 50.0 | .600 | 350.0 |
| 3 | 1 | 5.00 | 854.17 | .008 | .400 | 81.0 | 68.0 | 15.0 | 145.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 856.33 | .009 | .500 | 81.0 | 70.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 858.82 | .009 | .700 | 87.0 | 72.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 860.99 | .011 | .700 | 76.0 | 71.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 863.59 | .011 | .750 | 82.0 | 74.0 | 7.5 | 165.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 866.01 | .008 | .700 | 95.0 | 75.0 | 7.5 | 160.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 868.01 | .008 | .600 | 94.0 | 76.0 | 8.0 | 160.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 870.31 | .014 | .750 | 98.0 | 77.0 | 10.0 | 165.0 | | .600 | 450.0 |
| 5 | 1 | 5.00 | 872.79 | .014 | .700 | 100.0 | 78.0 | 14.0 | 165.0 | | .600 | 450.0 |
| 6 | 1 | 5.00 | 875.34 | .011 | .750 | 82.0 | 79.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 878.03 | .011 | .800 | 89.0 | 79.0 | 7.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 880.37 | .008 | .800 | 93.0 | 80.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 882.00 | .008 | .550 | 98.0 | 80.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 884.03 | .010 | .550 | 98.0 | 81.0 | 8.0 | 160.0 | 70.0 | .600 | 350.0 |
| 6 | 1 | 5.00 | 886.26 | .010 | .650 | 100.0 | 82.0 | 10.0 | 160.0 | | .600 | 350.0 |
| 7 | 1 | 5.00 | 888.17 | .006 | .550 | 86.0 | 82.0 | 8.0 | 155.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 889.99 | .006 | .450 | 90.0 | 82.0 | 8.0 | 150.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 891.61 | .005 | .400 | 95.0 | 82.0 | 10.0 | 155.0 | 60.0 | .600 | 250.0 |

[illegible]

[illegible]

RUN 5 DATE = 12-04-75

| ATMOS TEMP (DEG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (UCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.11 | 0.00 | 509.0 | 2515.50 | 6815.60 | .20 | 909.35 | 7.3 | 15.0 | 2.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (UCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 911.14 | .006 | .650 | 56.0 | 56.0 | 5.0 | 155.0 | | .600 | 100.0 |
| 1 | 1 | 5.00 | 912.95 | .006 | .650 | 55.0 | 56.0 | 5.5 | 155.0 | | .600 | 100.0 |
| 1 | 1 | 5.00 | 914.55 | .006 | .605 | 66.0 | 56.0 | 6.5 | 155.0 | 55.0 | .600 | 100.0 |
| 1 | 1 | 5.00 | 916.25 | .006 | .350 | 66.0 | 57.0 | 6.0 | 150.0 | | .600 | 100.0 |
| 2 | 1 | 5.00 | 918.20 | .008 | .950 | 66.0 | 62.0 | 8.0 | 150.0 | | .600 | 150.0 |
| 2 | 1 | 5.00 | 920.11 | .008 | .950 | 77.0 | 62.0 | 10.0 | 150.0 | | .600 | 150.0 |
| 2 | 1 | 5.00 | 922.36 | .009 | .500 | 81.0 | 65.0 | 10.5 | 145.0 | | .600 | 150.0 |
| 2 | 1 | 5.00 | 924.93 | .008 | .600 | 86.0 | 65.0 | 11.0 | 145.0 | | .600 | 150.0 |
| 6 | 1 | 5.00 | 926.50 | .009 | .550 | 75.0 | 70.0 | 11.0 | 155.0 | | .600 | 150.0 |
| 6 | 1 | 5.00 | 928.65 | .008 | .500 | 80.0 | 72.0 | 11.0 | 160.0 | | .600 | 150.0 |
| 6 | 1 | 5.00 | 930.73 | .008 | .500 | 90.0 | 74.0 | 12.0 | 160.0 | 65.0 | .600 | 150.0 |
| 6 | 1 | 5.00 | 932.70 | .008 | .500 | 92.0 | 74.0 | 12.0 | 160.0 | | .600 | 150.0 |
| 3 | 1 | 5.00 | 934.63 | .008 | .400 | 75.0 | 76.0 | 5.0 | 155.0 | | .600 | 100.0 |
| 3 | 1 | 5.00 | 936.30 | .008 | .400 | 81.0 | 77.0 | 5.0 | 160.0 | | .600 | 100.0 |
| 3 | 1 | 5.00 | 938.67 | .009 | .500 | 90.0 | 78.0 | 6.0 | 160.0 | 65.0 | .600 | 150.0 |
| 3 | 1 | 5.00 | 940.55 | .009 | .500 | 91.0 | 79.0 | 6.0 | 160.0 | | .600 | 150.0 |

TABLE C-1 (Concluded)

RUN= 5 DATE= 12-[illegible]-75

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.DEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 5.00 | 942.09 | .011 | .700 | 73.0 | 65.0 | 6.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 945.29 | .011 | .700 | 79.0 | 75.0 | 7.5 | 155.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 947.63 | .011 | .650 | 91.0 | 76.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 5 | 1 | 5.00 | 950.01 | .011 | .650 | 95.0 | 77.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 952.39 | .011 | .700 | 83.0 | 80.0 | 10.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 954.77 | .011 | .650 | 90.0 | 81.0 | 11.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 957.19 | .011 | .700 | 100.0 | 83.0 | 11.5 | 165.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 959.60 | .011 | .700 | 103.0 | 83.0 | 12.0 | 160.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 961.40 | .006 | .500 | 86.0 | 84.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 963.18 | .006 | .400 | 89.0 | 85.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 964.95 | .006 | .350 | 95.0 | 86.0 | 5.5 | 165.0 | 65.0 | .600 | 300.0 |
| 7 | 1 | 5.00 | 966.73 | .006 | .300 | 97.0 | 87.0 | 6.5 | 165.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 969.13 | .011 | .650 | 90.0 | 86.0 | 10.0 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 971.54 | .011 | .650 | 96.0 | 88.0 | 10.5 | 165.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 973.93 | .011 | .650 | 104.0 | 88.0 | 11.5 | 160.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 976.43 | .011 | .650 | 100.0 | 90.0 | 12.0 | 160.0 | | .600 | 400.0 |

TABLE C-4

[illegible]

[illegible] F  DATE= 12-05-75

| ATMOS TEMP (DEG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 9.2 | 17.2 | 4.1 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 978.81 | .004 | .300 | 64.0 | 66.0 | 4.0 | 155.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 980.18 | .004 | .250 | 68.0 | 67.0 | 4.0 | 155.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 981.61 | .004 | .250 | 72.0 | 67.0 | 4.0 | 150.0 | 60.0 | .600 | 250.0 |
| 1 | 1 | 5.00 | 983.08 | .004 | .250 | 74.0 | 68.0 | 4.0 | 150.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 984.80 | .006 | .350 | 72.0 | 70.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 986.52 | .006 | .300 | 77.0 | 71.0 | 6.0 | 150.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 988.47 | .008 | .400 | 85.0 | 73.0 | 8.0 | 150.0 | 65.0 | .600 | 350.0 |
| 2 | 1 | 5.00 | 990.56 | .008 | .500 | 88.0 | 74.0 | 8.5 | 150.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 992.31 | .006 | .350 | 78.0 | 76.0 | 10.0 | 165.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 994.20 | .006 | .450 | 81.0 | 77.0 | 11.0 | 160.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 995.95 | .006 | .400 | 90.0 | 78.0 | 12.0 | 165.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 997.72 | .006 | .400 | 92.0 | 79.0 | 12.0 | 160.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 999.19 | .004 | .300 | 80.0 | 80.0 | 4.0 | 160.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 1000.66 | .004 | .250 | 82.0 | 80.0 | 5.0 | 160.0 | | .600 | 250.0 |

TABLE C-4 (Concluded)

RUN- 9 DATE- 12-05-75

| PORT- POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 1 | 5.00 | 1002.10 | .004 | .250 | 88.0 | 81.0 | 5.0 | 160.0 | 60.0 | .600 | 250.0 |
| 9 | 1 | 5.00 | 1003.40 | .004 | .250 | 90.0 | 82.0 | 6.0 | 160.0 | | .600 | 250.0 |
| 9 | 1 | 5.00 | 1005.61 | .008 | .450 | 70.0 | 74.0 | 9.0 | 160.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1007.39 | .008 | .450 | 74.0 | 74.0 | 10.0 | 165.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1009.51 | .008 | .550 | 84.0 | 74.0 | 11.0 | 165.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1011.81 | .008 | .550 | 87.0 | 75.0 | 11.0 | 170.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1013.81 | .008 | .550 | 77.0 | 77.0 | 5.0 | 170.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1015.84 | .008 | .500 | 81.0 | 78.0 | 9.0 | 165.0 | | .600 | 350.0 |
| 9 | 1 | 5.00 | 1017.84 | .007 | .450 | 92.0 | 79.0 | 10.0 | 160.0 | | .600 | 325.0 |
| 9 | 1 | 5.00 | 1019.61 | .007 | .350 | 94.0 | 88.0 | 9.0 | 165.0 | | .600 | 325.0 |
| 9 | 1 | 5.00 | 1021.79 | .010 | .700 | 84.0 | 80.0 | 12.0 | 185.0 | | .600 | 400.0 |
| 9 | 1 | 5.00 | 1023.97 | .010 | .700 | 92.0 | 82.0 | 12.0 | 185.0 | | .600 | 400.0 |
| 9 | 1 | 5.00 | 1026.25 | .010 | .650 | 95.0 | 83.0 | 12.0 | 190.0 | | .600 | 400.0 |
| 9 | 1 | 5.00 | 1028.50 | .010 | .650 | 103.0 | 84.0 | 12.5 | 185.0 | | .600 | 400.0 |
| 0 | 1 | 5.00 | 1029.94 | .004 | .400 | 80.0 | 80.0 | 5.0 | 180.0 | | .600 | 250.0 |
| 0 | 1 | 5.00 | 1031.42 | .004 | .400 | 81.0 | 81.0 | 9.0 | 175.0 | | .600 | 250.0 |
| 0 | 1 | 5.00 | 1032.96 | .005 | .300 | 86.0 | 82.0 | 9.0 | 175.0 | | .600 | 275.0 |
| 0 | 1 | 5.00 | 1034.54 | .005 | .300 | 89.0 | 81.0 | 9.0 | 175.0 | | .600 | 275.0 |

TABLE C-1

ORGANIC DATA AND CALCULATED VALUES

Run- 9 Date- 12-06-75

| ORIFICE TEMP (DEG.F) | ORIFICE PRES (I.H2O) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 68.0 | 29.05 | 0.00 | 316.0 | 2955.50 | 6491.20 | .20 | 34.54 | 6.4 | 16.1 | 1.5 | .850 |

| POINT- POINT | CLOCK TIME (MIN) | METER VOL (CUF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.00 | 26.12 | .006 | .300 | 40.0 | 40.0 | 4.0 | 155.0 | | .600 | 300.0 |
| A | 5.00 | 27.00 | .006 | .350 | 43.0 | 41.0 | 5.0 | 160.0 | | .600 | 300.0 |
| A | 5.00 | 29.44 | .006 | .400 | 49.0 | 47.0 | 6.5 | 160.0 | | .600 | 300.0 |
| B | 5.00 | 31.17 | .006 | .400 | 48.0 | 45.0 | 8.0 | 145.0 | | .600 | 300.0 |
| B | 5.00 | 32.73 | .006 | .400 | 51.0 | 46.0 | 8.0 | 145.0 | | .600 | 300.0 |
| B | 5.00 | 34.51 | .006 | .400 | 57.0 | 47.0 | 9.0 | 145.0 | | .600 | 300.0 |
| C | 5.00 | 36.19 | .006 | .400 | 51.0 | 50.0 | 9.0 | 150.0 | | .600 | 300.0 |
| C | 5.00 | 37.87 | .006 | .400 | 55.0 | 50.0 | 9.5 | 155.0 | | .600 | 300.0 |
| C | 5.00 | 39.55 | .006 | .350 | 58.0 | 51.0 | 10.0 | 155.0 | | .600 | 300.0 |
| D | 5.00 | 50.00 | .004 | .250 | 54.0 | 52.0 | 10.0 | 150.0 | | .600 | 250.0 |
| D | 5.00 | 52.36 | .004 | .250 | 58.0 | 52.0 | 10.5 | 155.0 | | .600 | 250.0 |
| D | 5.00 | 53.78 | .004 | .250 | 60.0 | 53.0 | 11.0 | 155.0 | | .600 | 250.0 |

TABLE C-1 (Concluded)

RUN- 9 DATE- 12-06-75

| POINT-POINT | | COMP TIME (MIN) | METER VOL (CU.F) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.PEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.00 | 55.51 | .006 | .400 | 55.0 | 54.0 | 4.0 | 165.0 | | .600 | 300.0 |
| 0 | 1 | 5.00 | 57.10 | .006 | .350 | 59.0 | 55.0 | 5.0 | 165.0 | | .600 | 300.0 |
| 0 | 1 | 5.00 | 58.69 | .006 | .300 | 63.0 | 55.0 | 7.5 | 165.0 | | .600 | 300.0 |
| 0 | 1 | 5.00 | 60.44 | .006 | .400 | 54.0 | 55.0 | 11.0 | 165.0 | | .600 | 300.0 |
| 0 | 1 | 5.00 | 62.05 | .006 | .350 | 50.0 | 56.0 | 11.0 | 170.0 | | .600 | 300.0 |
| 0 | 1 | 5.00 | 63.70 | .006 | .350 | 63.0 | 56.0 | 12.0 | 170.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 65.39 | .006 | .350 | 60.0 | 56.0 | 11.0 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 67.09 | .006 | .350 | 64.0 | 56.0 | 12.5 | 155.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 68.77 | .006 | .350 | 60.0 | 54.0 | 13.0 | 160.0 | | .600 | 300.0 |

TABLE C-6

ORGANIC DATA AND CALCULATED VALUES

RUN- 11 DATE- 12-07-75

| AMBNT TEMP (DEG.F) | AMBNT PRES (IN.HG) | STACK VAC (IN.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80.0 | 29.65 | 0.00 | 370.0 | 4777.90 | 8821.20 | .20 | 70.83 | 5.1 | 18.2 | 5.5 | .850 |

| POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (IN.H2O) | DELTA H (IN.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (IN.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 72.13 | .004 | .250 | 44.0 | 45.0 | 3.0 | 170.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 73.50 | .004 | .250 | 47.0 | 45.0 | 4.0 | 170.0 | | .600 | 250.0 |
| 1 | 1 | 5.00 | 74.88 | .004 | .250 | 51.0 | 45.0 | 6.0 | 170.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 76.66 | .008 | .400 | 48.0 | 46.0 | 9.0 | 200.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 78.44 | .008 | .400 | 53.0 | 47.0 | 9.0 | 200.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 80.25 | .008 | .400 | 59.0 | 47.0 | 9.5 | 205.0 | 56.0 | .600 | 350.0 |
| 3 | 1 | 5.00 | 81.87 | .006 | .300 | 52.0 | 48.0 | 9.5 | 170.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 83.43 | .006 | .300 | 58.0 | 49.0 | 11.0 | 160.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 84.83 | .006 | .300 | 62.0 | 50.0 | 13.5 | 160.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 86.49 | .006 | .350 | 52.0 | 50.0 | 3.0 | 170.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 88.34 | .006 | .400 | 57.0 | 51.0 | 3.0 | 185.0 | 50.0 | .600 | 300.0 |
| 5 | 1 | 5.00 | 90.09 | .006 | .400 | 63.0 | 51.0 | 4.0 | 190.0 | | .600 | 300.0 |

TABLE C-6 (Concluded)

RUN- 11 DATE- 12-07-75

| POINT NO. | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 1 | 5.00 | 91.09 | .006 | .400 | 55.0 | 52.0 | 4.0 | 175.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 93.32 | .006 | .350 | 59.0 | 53.0 | 4.0 | 180.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 94.96 | .006 | .350 | 65.0 | 54.0 | 5.0 | 180.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 96.57 | .006 | .350 | 53.0 | 54.0 | 5.0 | 185.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 98.18 | .006 | .350 | 57.0 | 55.0 | 6.0 | 195.0 | 55.0 | .600 | 300.0 |
| 7 | 1 | 5.00 | 99.72 | .006 | .300 | 61.0 | 55.0 | 6.0 | 190.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 101.28 | .006 | .300 | 59.0 | 55.0 | 7.0 | 205.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 102.85 | .006 | .300 | 62.0 | 56.0 | 8.0 | 205.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 104.42 | .006 | .300 | 65.0 | 57.0 | 8.0 | 205.0 | | .600 | 300.0 |
| 9 | 1 | 5.00 | 105.94 | .005 | .250 | 60.0 | 58.0 | 7.0 | 335.0 | | .600 | 300.0 |
| 9 | 1 | 5.00 | 107.04 | .005 | .200 | 62.0 | 58.0 | 7.0 | 330.0 | 50.0 | .600 | 300.0 |
| 9 | 1 | 5.00 | 108.16 | .005 | .200 | 65.0 | 58.0 | 8.0 | 330.0 | | .600 | 300.0 |

TABLE C-7

INPUT DATA AND CALCULATED VALUES

RUN- 13 DATE- 12-08-79

| AMBIENT TEMP (DEG.F) | ATMOS PRES (IN.HG) | STACK VAC (IN.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80.0 | 29.35 | 0.00 | 92.9 | 1813.70 | 1898.20 | .20 | 111.14 | 1.1 | 22.3 | 6.7 | .850 |

| POINT- POINT | CLOCK TIME (MINS) | METER VOL (DCF) | DELTA P (IN.H2O) | DELTA H (IN.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (IN.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.00 | 112.65 | .005 | .250 | 42.0 | 45.0 | 9.0 | 320.0 | .600 | 300.0 |
| 1 | 1 | 0.00 | 113.52 | .005 | .200 | 45.0 | 45.0 | 14.0 | 325.0 | .600 | 300.0 |
| 1 | 1 | 0.00 | 115.01 | .005 | .300 | 50.0 | 45.0 | 5.0 | 290.0 | .600 | 300.0 |
| 2 | 1 | 0.00 | 116.04 | .003 | .100 | 42.0 | 44.0 | 10.0 | 320.0 | .600 | 250.0 |
| 2 | 1 | 0.00 | 118.76 | .003 | .050 | 45.0 | 45.0 | 15.0 | 330.0 | .600 | 250.0 |

TABLE C-4

[illegible] DATA AND CALCULATED VALUES

RUN= 1A DATE= 12-08-79

| ATMOS TEMP (DEG.F) | ATMOS PRES (IN.HG) | STATIC SUC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | | | | | | | | | |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL. (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 118.09 | .005 | .200 | 43.0 | 45.0 | 2.5 | 325.0 | 50.0 | .600 | 300.0 |
| 1 | 1 | 5.00 | 119.36 | .005 | .200 | 46.0 | 46.0 | 5.0 | 320.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 120.21 | .002 | .100 | 46.0 | 46.0 | 7.0 | 325.0 | | .600 | 200.0 |
| 2 | 1 | 5.00 | 120.98 | .002 | .100 | 47.0 | 47.0 | 12.0 | 330.0 | | .600 | 200.0 |
| 4 | 1 | 5.00 | 122.15 | .003 | .200 | 50.0 | 48.0 | 4.0 | 235.0 | | .600 | 220.0 |
| 4 | 1 | 5.00 | 123.22 | .003 | .200 | 53.0 | 48.0 | 10.0 | 245.0 | 50.0 | .600 | 220.0 |
| 3 | 1 | 5.00 | 124.27 | .003 | .200 | 45.0 | 47.0 | 4.0 | 200.0 | | .600 | 200.0 |
| 3 | 1 | 5.00 | 125.27 | .002 | .150 | 47.0 | 47.0 | 11.0 | 215.0 | | .600 | 200.0 |
| 5 | 1 | 5.00 | 126.59 | .006 | .250 | 46.0 | 47.0 | 8.0 | 335.0 | | .600 | 340.0 |
| 5 | 1 | 5.00 | 127.71 | .006 | .150 | 48.0 | 47.0 | 8.0 | 335.0 | 50.0 | .600 | 340.0 |
| 6 | 1 | 5.00 | 129.27 | .004 | .300 | 49.0 | 47.0 | 4.0 | 295.0 | | .600 | 280.0 |
| 6 | 1 | 5.00 | 130.45 | .004 | .300 | 54.0 | 48.0 | 9.0 | 325.0 | | .600 | 280.0 |
| 7 | 1 | 5.00 | 132.00 | .004 | .300 | 52.0 | 49.0 | 1.0 | 300.0 | | .600 | 280.0 |
| 7 | 1 | 5.00 | 133.17 | .004 | .250 | 55.0 | 50.0 | 2.0 | 325.0 | | .600 | 280.0 |

TABLE C-9

ORGANIC EMISSION DATA

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 30.0 | 240.0 | 160.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.26 | 29.31 | 29.31 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .442 | .506 | .539 |
| VM | VOL DRY GAS-METER COND | DCF | 11.35 | 96.34 | 67.08 |
| TM | AVG GAS METER TEMP | DEG.F | 68.4 | 75.5 | 79.8 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.15 | 93.53 | 64.61 |
| VW | TOTAL H2O COLLECTED | ML | 31.0 | 675.2 | 598.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 1.47 | 32.00 | 28.35 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| MD | MOLE FRACTION DRY GAS | | .884 | .745 | .695 |
| PCO2 | PERCENT CO2 BY VOL. DRY | | 11.0 | 11.0 | 15.0 |
| PO2 | PERCENT O2 BY VOL. DRY | | 9.2 | 9.2 | 7.3 |
| PCO | PERCENT CO BY VOL. DRY | | 1.9 | 1.9 | 2.9 |
| PN2 | PERCENT N2 BY VOL. DRY | | 77.9 | 77.9 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.13 | 30.69 |
| MW | MOLECULAR WT-STK GAS | | 28.72 | 27.04 | 26.82 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .007 | .008 | .008 |
| TS | AVG STACK TEMPERATURE | DEG.F | 52.0 | 150.5 | 156.3 |
| NP | NET SAMPLING POINTS | | 6 | 48 | 32 |
| PST | STATIC PRESS OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.26 | 29.31 | 29.31 |
| VS | AVG STACK GAS VELOCITY | FPM | 275 | 332 | 353 |
| AS | STACK AREA | IN2 | [illegible] a/ | 26 | 26 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | [illegible] a/ | 42 | 41 |
| QA | ACTUAL STACK FLOWRATE | ACFM | [illegible] a/ | 66 | 71 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.7 | 95.5 |
| MF | PARTICULATE WT-PARTIAL | MG | 554.90 | 1574.60 | 2515.50 |
| MT | PARTICULATE WT-TOTAL | MG | 646.70 | 3367.30 | 6015.41 |
| IC | PERC IMPINGER CATCH | | 14.20 | 53.26 | 63.14 |
| CAN | PART. LOAD-PTL.STD CN | GR/DSCF | .76576 | .25926 | .59961 |
| CAO | PART. LOAD-TTL.STD CN | GR/DSCF | .89350 | .55443 | 1.42655 |
| CAT | PART. LOAD-PTL.STK CN | GR/ACF | .60577 | .16427 | .36997 |
| CAU | PART. LOAD-TTL.STK CN | GR/ACF | .70822 | .35129 | .96019 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | [illegible] | [illegible] b/ | [illegible] b/ |
| CAX | PARTIC EMIS-TOTAL | LB/HR | [illegible] | [illegible] b/ | [illegible] b/ |
| EA | PERCENT EXCESS AIR | | 67 | 67 | 47 |

a/ Nominal [illegible] diameter stack.
b/ For stacks to obtain total [illegible], multiply by [illegible].

TABLE C-9 (Continued)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 160.0 | [illegible] | 120.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.25 | 29.65 | 29.65 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .412 | [illegible] | .314 |
| VM | VOL DRY GAS-METER COND | DCF | 57.26 | [illegible] | 37.53 |
| TM | AVG GAS METER TEMP | DEG.F | 70.9 | 53.3 | [illegible] |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 55.00 | 35.00 | 36.36 |
| VW | TOTAL H2O COLLECTED | ML | [illegible] | 314.6 | [illegible] |
| VWV | VOL H2O VAPOR-STD COND | SCF | [illegible] | 15.00 | [illegible] |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | [illegible] |
| MD | MOLE FRACTION DRY GAS | | .650 | [illegible] | [illegible] |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 17.2 | [illegible] | 18.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 4.2 | [illegible] | [illegible] |
| PCO | PERCENT CO BY VOL, DRY | | 4.1 | 1.5 | 5.5 |
| PN2 | PERCENT N2 BY VOL, DRY | | [illegible] | [illegible] | 71.2 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 30.43 | 31.17 |
| MW | MOLECULAR WT-STK GAS | | [illegible] | [illegible] | 27.00 |
| CP | PITOT TUBE COEFFICIENT | | [illegible] | [illegible] | [illegible] |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .006 | .004 |
| TS | AVG STACK TEMPERATURE | DEG.F | [illegible] | 157.1 | [illegible] |
| NP | NET SAMPLING POINTS | | 32 | 21 | [illegible] |
| PST | STATIC PRESS OF STACK | IN.HG | [illegible] | [illegible] | [illegible] |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.25 | 29.65 | 29.65 |
| VS | AVG STACK GAS VELOCITY | FPM | [illegible] | 283 | [illegible] |
| AS | STACK AREA | IN2 | 24 | 24 | [illegible] |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 33 | [illegible] | 33 |
| QA | ACTUAL STACK FLOWRATE | ACFM | [illegible] | [illegible] | [illegible] |
| PERI | PERCENT ISOKINETIC | | [illegible] | [illegible] | [illegible] |
| MF | PARTICULATE WT-PARTIAL | MG | [illegible] | [illegible] | [illegible] |
| MT | PARTICULATE WT-TOTAL | MG | [illegible] | [illegible] | [illegible] |
| IC | PERC IMPINGER CATCH | | [illegible] | [illegible] | [illegible] |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | [illegible] | [illegible] | [illegible] |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | [illegible] | [illegible] | [illegible] |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | [illegible] | [illegible] | [illegible] |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | [illegible] | [illegible] | [illegible] |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | [illegible] | [illegible] | [illegible] |
| CAX | PARTIC EMIS-TOTAL | LB/HR | [illegible] | [illegible] | [illegible] |
| EA | PERCENT EXCESS AIR | | [illegible] | [illegible] | [illegible] |

[illegible]

[illegible]

TABLE C-[illegible] (Concluded)

| NAME | DESCRIPTION | UNITS | [illegible] | [illegible] |
|---|---|---|---|---|
| | DATE OF RUN | | [illegible] | [illegible] |
| DN | PROBE TIP DIAMETER | IN | [illegible] | [illegible] |
| TT | NET TIME OF RUN | MIN | [illegible] | [illegible] |
| PB | BAROMETRIC PRESSURE | IN.HG | [illegible] | [illegible] |
| PM | AVG ORIFICE PRES DROP | IN.H2O | [illegible] | [illegible] |
| VM | VOL DRY GAS-METER COND | DCF | [illegible] | [illegible] |
| TM | AVG GAS METER TEMP | DEG.F | [illegible] | [illegible] |
| VMSTD | VOL DRY GAS-STD COND | DSCF | [illegible] | [illegible] |
| VW | TOTAL H2O COLLECTED | ML | [illegible] | [illegible] |
| VWV | VOL H2O VAPOR-STD COND | SCF | [illegible] | [illegible] |
| PMOS | PERCENT MOISTURE BY VOL | | [illegible] | [illegible] |
| MD | MOLE FRACTION DRY GAS | | [illegible] | [illegible] |
| PCO2 | PERCENT CO2 BY VOL, DRY | | [illegible] | [illegible] |
| PO2 | PERCENT O2 BY VOL, DRY | | [illegible] | [illegible] |
| PCO | PERCENT CO BY VOL, DRY | | [illegible] | [illegible] |
| PN2 | PERCENT N2 BY VOL, DRY | | [illegible] | [illegible] |
| MWD | MOLECULAR WT-DRY STK GAS | | [illegible] | [illegible] |
| MW | MOLECULAR WT-STK GAS | | [illegible] | [illegible] |
| CP | PITOT TUBE COEFFICIENT | | [illegible] | [illegible] |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | [illegible] | [illegible] |
| TS | AVG STACK TEMPERATURE | DEG.F | [illegible] | [illegible] |
| NP | NET SAMPLING POINTS | | [illegible] | [illegible] |
| PST | STATIC PRES OF STACK | [illegible] | [illegible] | [illegible] |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | [illegible] | [illegible] |
| VS | AVG STACK GAS VELOCITY | [illegible] | [illegible] | [illegible] |
| AS | STACK AREA | [illegible] | [illegible] | [illegible] |
| QS | STK FLOWRATE, DRY,STD CN | [illegible] | [illegible] | [illegible] |
| QA | ACTUAL STACK FLOWRATE | ACFM | [illegible] | [illegible] |
| PERI | PERCENT ISOKINETIC | | [illegible] | [illegible] |
| MF | PARTICULATE WT-PARTIAL | MG | [illegible] | [illegible] |
| MT | PARTICULATE WT-TOTAL | MG | [illegible] | [illegible] |
| IC | PERC IMPINGER CATCH | | [illegible] | [illegible] |
| CAN | PART. LOAD-PTL,STD CN | [illegible] | [illegible] | [illegible] |
| CAO | PART. LOAD-TTL,STD CN | [illegible] | [illegible] | [illegible] |
| CAT | PART. LOAD-PTL,STK CN | [illegible] | [illegible] | [illegible] |
| CAU | PART. LOAD-TTL,STK CN | [illegible] | [illegible] | [illegible] |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | [illegible] | [illegible] |
| CAX | PARTIC EMIS-TOTAL | LB/HR | [illegible] | [illegible] |
| PA | PERCENT EXCESS AIR | | [illegible] | [illegible] |

[illegible]

[illegible]

TABLE C-10

ORGANIC EMISSION DATA
(METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 30.0 | 240.0 | 180.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.26 | 29.31 | 29.31 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .442 | .506 | .539 |
| VM | VOL DRY GAS-METER COND | DCF | 11.35 | 96.34 | 67.08 |
| TM | AVG GAS METER TEMP | DEG.F | 68.4 | 75.5 | 79.8 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .32 | 2.65 | 1.83 |
| VW | TOTAL H2O COLLECTED | ML | 31.0 | 675.2 | 598.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .04 | .91 | .80 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| MD | MOLE FRACTION DRY GAS | | .884 | .745 | .695 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 11.0 | 15.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 9.2 | 7.3 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 1.9 | 2.9 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 77.9 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.13 | 30.69 |
| MW | MOLECULAR WT-STK GAS | | 28.72 | 27.04 | 26.82 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .007 | .008 | .008 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 11.1 | 65.8 | 70.1 |
| NP | NET SAMPLING POINTS | | 6 | 48 | 32 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.26 | 29.31 | 29.31 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 83.8 | 101.2 | 107.7 |
| AS | STACK AREA | IN2 | 11,310[a] | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 547[a] | 1.2 | 1.2 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 612[a] | 1.9 | 2.0 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| MF | PARTICULATE WT-PARTIAL | MG | 554.90 | 1574.60 | 2515.50 |
| MT | PARTICULATE WT-TOTAL | MG | 646.70 | 3367.30 | 6815.40 |
| IC | PERC IMPINGER CATCH | | 14.20 | 53.24 | 63.09 |
| CANM | PART. LOAD-PTL.STD CN | MG/NM3 | 1754.55 | 593.28 | 1372.10 |
| CAOM | PART. LOAD-TTL.STD CN | MG/NM3 | 2044.82 | 1268.73 | 3717.52 |
| CATM | PART. LOAD-PTL.STK CN | MG/M3 | 1569.28 | 375.90 | 800.85 |
| CAUM | PART. LOAD-TTL.STK CN | MG/M3 | 1828.89 | 803.87 | 2169.79 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | 58 | .042[b] | .096[b] |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | 67 | .091[b] | .260[b] |
| EA | PERCENT EXCESS AIR | | 67 | 67 | 42 |

a/ Nominal 10-ft (120 in.) diameter stack.

b/ Per stack; to obtain total for kiln, multiply by 8.

TABLE C-10 (Continued)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 160.0 | 105.0 | 120.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.25 | 29.65 | 29.65 |
| DH | AVG ORIFICE PRES DROP | IN.H2O | .412 | .350 | .319 |
| VM | VOL DRY GAS-METER COND | DCF | 57.24 | 34.18 | 37.53 |
| TM | AVG GAS METER TEMP | DEG.F | 79.6 | 53.3 | 54.4 |
| VMSTM | VOL DRY GAS-STD COND | NCM | 1.54 | .99 | 1.09 |
| VW | TOTAL H2O COLLECTED | ML | 624.7 | 316.4 | 370.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .64 | .42 | .50 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| MD | MOLE FRACTION DRY GAS | | .650 | .700 | .686 |
| PCO2 | PERCENT CO2 BY VOL. DRY | | 17.2 | 16.1 | 18.2 |
| PO2 | PERCENT O2 BY VOL. DRY | | 6.2 | 6.4 | 5.1 |
| PCO | PERCENT CO BY VOL. DRY | | 4.1 | 1.5 | 5.5 |
| PN2 | PERCENT N2 BY VOL. DRY | | 69.5 | 76.0 | 71.2 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 30.83 | 31.12 |
| MS | MOLECULAR WT-STK GAS | | 26.53 | 26.98 | 27.00 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .006 | .006 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 73.8 | 69.5 | 94.8 |
| NP | NET SAMPLING POINTS | | 32 | 21 | 24 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.25 | 29.65 | 29.65 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 94.3 | 89.3 | 91.5 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .9 | 1.0 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.8 | 1.7 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| MP | PARTICULATE WT-PARTIAL | MG | 7994.00 | 2855.50 | 4777.90 |
| MT | PARTICULATE WT-TOTAL | MG | 48040.40 | 6491.20 | 8821.20 |
| IC | PERC IMPINGER CATCH | | 83.36 | 56.01 | 45.84 |
| CANM | PART. LOAD-PTL.STD CN | MG/NM3 | 5123.51 | 2874.98 | 4390.16 |
| CADM | PART. LOAD-TTL.STD CN | MG/NM3 | 30782.30 | 6535.49 | 8105.33 |
| CATM | PART. LOAD-PTL.STK CN | MG/M3 | 2761.64 | 1712.83 | 2387.56 |
| CAUM | PART. LOA -TTL.STK CN | MG/M3 | 16592.09 | 3893.66 | 4408.03 |
| CAMM | PARTIC EMIS-PARTIAL | KG/HR | .290[a] | .170[b] | .243[a] |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | 1.744[a] | .387[b] | .449[a] |
| EA | PERCENT EXCESS AIR | | 64 | 39 | 14 |

a/ Per stack; to obtain total for kiln, multiply by 8.
b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE C-10 (Concluded)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 25.0 | 70.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.35 | 29.35 |
| DM | AVG ORIFICE PRES DROP | IN.H2O | .180 | .207 |
| VM | VOL DRY GAS-METER COND | DCF | 5.62 | 16.41 |
| TM | AVG GAS METER TEMP | DEG.F | 44.8 | 46.0 |
| VMSTN | VOL DRY GAS-STD COND | NCM | .16 | .48 |
| VW | TOTAL H2O COLLECTED | ML | 52.5 | 176.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .07 | .24 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| MD | MOLE FRACTION DRY GAS | | .699 | .668 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 22.3 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 1.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 6.7 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 69.9 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.61 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.52 | 27.10 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .004 | .004 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 158.3 | 145.3 |
| NP | NET SAMPLING POINTS | | 5 | 14 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.35 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 85.4 | 79.3 |
| AS | STACK AREA | IN2 | 29 | 2 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .7 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.5 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| MF | PARTICULATE WT-PARTIAL | MG | 1013.70 | 4911.40 |
| MT | PARTICULATE WT-TOTAL | MG | 1698.20 | 6965.90 |
| IC | PERC IMPINGER CATCH | | 40.31 | 29.49 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 6169.01 | 10299.68 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 10334.63 | 14608.16 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 2887.09 | 4748.56 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 4836.60 | 6734.94 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | .275[a/] | .420[b/] |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | .460[a/] | .595[b/] |
| EA | PERCENT EXCESS AIR | | -11 | -11 |

a/ Per stack; to obtain total, multiply by 1.67.

b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE C-11

SUMMARY OF RESULTS (ORGANIC)

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.15 | 93.53 | 64.61 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| TS | AVG STACK TEMPERATURE | DEG.F | 52.0 | 150.5 | 158.3 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 11,310[a] | 42 | 41 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 21,601[a] | 66 | 71 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 554.90 | 1574.60 | 2515.50 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | .76674 | .25926 | .59961 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | .68577 | .16427 | .34997 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | 180 | .09[b] | .21[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 646.70 | 3367.30 | 6815.40 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | .89358 | .55443 | 1.62455 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | .79922 | .35129 | .94819 |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 219 | .20[b] | .57[b] |
| IC | PERC IMPINGER CATCH | | 14.20 | 53.24 | 63.09 |

a/ Nominal 10-ft (120 in.) diameter stack.

b/ Per stack; to obtain total for kiln, multiply by 8.

TABLE C-11 (Continued)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 55.00 | 35.00 | 38.35 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| TS | AVG STACK TEMPERATURE | DEG.F | 164.8 | 157.1 | 202.7 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 33 | 35 | 33 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 62 | 59 | 60 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 7996.00 | 2855.50 | 4777.90 |
| CAN | PART. LOAD-PTL.STD CN | GR/DSCF | 2.23096 | 1.25636 | 1.91849 |
| CAT | PART. LOAD-PTL.STK CN | GR/ACF | 1.20683 | .74851 | 1.04336 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | .64[a] | .38[b] | .54[a] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 48040.40 | 6491.20 | 8821.20 |
| CAO | PART. LOAD-TTL.STD CN | GR/DSCF | 13.45180 | 2.85599 | 3.54201 |
| CAU | PART. LOAD-TTL.STK CN | GR/ACF | 7.25071 | 1.70152 | 1.92630 |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 3.85[a] | .85[b] | .99[a] |
| IC | PERC IMPINGER CATCH | | 83.36 | 56.01 | 45.84 |

a/ Per stack; to obtain total for kiln, multiply by 8.
b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE C-11 (Concluded)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 5.79 | 16.80 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| TS | AVG STACK TEMPERATURE | DEG.F | 317.0 | 293.6 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 26 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 56 | 52 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 1013.70 | 4911.40 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 2.69585 | 4.50094 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 1.26165 | 2.07511 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | .61[a] | .92[b] |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 1698.20 | 6965.90 |
| CAO | PART. LOAD-TTL,STD CN | GR/DSCF | 4.51621 | 6.38374 |
| CAU | PART. LOAD-TTL,STK CN | GR/ACF | 2.11358 | 2.94315 |
| CAX | PARTIC EMIS-TOTAL | LB/HR | 1.01[a] | 1.31[b] |
| IC | PERC IMPINGER CATCH | | 40.31 | 29.49 |

a/ Per stack; to obtain total, multiply by 1.67.

b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE C-12

SUMMARY OF RESULTS--METRIC UNITS (ORGANIC)

| NAME | DESCRIPTION | UNITS | 1 | 3 | 5 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-02-75 | 12-03-75 | 12-04-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .316 | 2.649 | 1.829 |
| PMOS | PERCENT MOISTURE BY VOL | | 11.6 | 25.5 | 30.5 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 11.1 | 65.8 | 70.1 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 547[a] | 1.2 | 1.2 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 612[a] | 1.9 | 2.0 |
| PERI | PERCENT ISOKINETIC | | 76.7 | 94.0 | 99.5 |
| EA | PERCENT EXCESS AIR | | 67 | 67 | 42 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 554.90 | 1574.60 | 2515.50 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 1754.55 | 593.28 | 1372.10 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 1569.28 | 375.90 | 800.85 |
| CAMM | PARTIC EMIS-PARTIAL | KG/HR | 58 | .042[b] | .046[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 646.70 | 3367.30 | 6815.40 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 2044.82 | 1268.73 | 3717.52 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 1828.89 | 803.87 | 2169.79 |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | 67 | .091[b] | .260[b] |
| IC | PERC IMPINGER CATCH | | 14.20 | 53.24 | 63.09 |

[a] Nominal 10-ft (120 in.) diameter stack.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE C-12 (Continued)

| NAME | DESCRIPTION | UNITS | 7 | 9 | 11 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-05-75 | 12-06-75 | 12-07-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | 1.557 | .991 | 1.086 |
| PMOS | PERCENT MOISTURE BY VOL | | 35.0 | 30.0 | 31.4 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 73.8 | 69.5 | 94.8 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .9 | 1.0 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.8 | 1.7 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 104.6 | 97.0 | 99.4 |
| EA | PERCENT EXCESS AIR | | 64 | 39 | 14 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 7996.00 | 2855.50 | 4777.90 |
| CANM | PART. LOAD-PTL.STD CN | MG/NM3 | 5123.51 | 2874.98 | 4390.16 |
| CATM | PART. LOAD-PTL.STK CN | MG/M3 | 2761.64 | 1712.83 | 2387.56 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | .290[a] | .170[b] | .243[a] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 48040.40 | 6491.20 | 8821.20 |
| CAOM | PART. LOAD-TTL.STD CN | MG/NM3 | 30782.30 | 6535.49 | 8105.33 |
| CAUM | PART. LOAD-TTL.STK CN | MG/M3 | 16592.09 | 3893.66 | 4409.03 |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | 1.744[a] | .387[b] | .449[a] |
| IC | PERC IMPINGER CATCH | | 83.36 | 56.01 | 45.84 |

a/ Per stack; to obtain total for kiln, multiply by 8.
b/ Per stack; to obtain total for kiln, multiply by 7.

TABLE C-12 (Concluded)

| NAME | DESCRIPTION | UNITS | 13 | 14 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-08-75 | 12-08-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .164 | .476 |
| PMOS | PERCENT MOISTURE BY VOL | | 30.1 | 33.2 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 158.3 | 145.3 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .7 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.5 |
| PERI | PERCENT ISOKINETIC | | 89.7 | 101.7 |
| EA | PERCENT EXCESS AIR | | -11 | -11 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 1013.70 | 4911.40 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 6169.01 | 10299.68 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 2887.09 | 4748.56 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | .275[a/] | .420[b/] |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL | MG | 1698.20 | 6965.90 |
| CAOM | PART. LOAD-TTL,STD CN | MG/NM3 | 10334.63 | 14608.16 |
| CAUM | PART. LOAD-TTL,STK CN | MG/M3 | 4836.60 | 6734.94 |
| CAXM | PARTIC EMIS-TOTAL | KG/HR | .460[a/] | .595[b/] |
| IC | PERC IMPINGER CATCH | | 40.31 | 29.49 |

a/ Per stack; to obtain total, multiply by 1.67.

b/ Per stack; to obtain total for kiln, multiply by 7.

APPENDIX D

RESULTS OF ANALYSIS - COMPUTER COMPUTATIONS
(POLYCYCLIC ORGANIC MATERIALS)

TABLE D-1

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 2 DATE- 12-03-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.31 | 0.00 | 109.8 | 15.40[a/] | 15.40[a/] | .20 | 837.66 | 9.2 | 11.0 | 1.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 838.98 | .005 | .270 | 43.0 | 43.0 | 8.5 | 140.0 | | .600 | 260.0 |
| 2 | 1 | 5.00 | 840.69 | .006 | .400 | 49.0 | 49.0 | 5.0 | 145.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 842.82 | .009 | .650 | 53.0 | 53.0 | 5.0 | 130.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 845.03 | .009 | .700 | 58.0 | 60.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 847.27 | .011 | .700 | 62.0 | 62.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 849.49 | .011 | .650 | 64.0 | 64.0 | 7.0 | 155.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 851.22 | .004 | .450 | 65.0 | 66.0 | 12.0 | 165.0 | | .600 | 250.0 |
| 8 | 1 | 5.00 | 853.23 | .008 | .550 | 65.0 | 65.0 | 12.0 | 165.0 | | .600 | 350.0 |

a/ x $10^{-3}$.

TABLE D-2

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 4 DATE- 12-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.31 | 0.00 | 134.4 | 3.40[a] | 23.40[a] | .20 | 853.51 | 7.3 | 15.0 | 2.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 854.97 | .004 | .500 | 64.0 | 66.0 | 5.0 | 150.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 857.01 | .008 | .600 | 58.0 | 60.0 | 7.5 | 145.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 859.01 | .008 | .550 | 61.0 | 61.0 | 5.5 | 160.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 860.85 | .007 | .500 | 64.0 | 64.0 | 5.0 | 160.0 | | .600 | 320.0 |
| 5 | 1 | 5.00 | 863.15 | .011 | .700 | 68.0 | 68.0 | 12.0 | 165.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 865.45 | .011 | .700 | 72.0 | 72.0 | 9.0 | 150.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 867.35 | .006 | .600 | 73.0 | 73.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 869.71 | .011 | .700 | 75.0 | 75.0 | 13.0 | 155.0 | | .600 | 400.0 |

a/ x $10^{-3}$.

TABLE D-3

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 6 DATE- 12-05-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.25 | -0.00 | 154.8 | 11.00[a] | 11.00[a] | .20 | 869.81 | 9.2 | 17.2 | 4.1 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 871.25 | .004 | .300 | 68.0 | 70.0 | 5.0 | 155.0 | 70.0 | .600 | 250.0 |
| 2 | 1 | 5.00 | 872.97 | .006 | .350 | 67.0 | 67.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 874.84 | .006 | .450 | 67.0 | 67.0 | 5.0 | 150.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 876.42 | .004 | .300 | 69.0 | 69.0 | 5.0 | 160.0 | | .600 | 250.0 |
| 5 | 1 | 5.00 | 878.15 | .006 | .400 | 66.0 | 67.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 879.83 | .006 | .400 | 68.0 | 68.0 | 8.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 882.05 | .010 | .700 | 70.0 | 70.0 | 10.5 | 180.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 883.70 | .006 | .400 | 70.0 | 70.0 | 7.0 | 185.0 | | .600 | 300.0 |

[a] x $10^{-3}$.

TABLE D-4

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 8 DATE- 12-06-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 96.1 | 0.00[a] | 19.80[b] | .20 | 883.70 | 6.4 | 16.1 | 1.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 5.00 | 885.07 | .004 | .250 | 44.0 | 46.0 | 4.0 | 150.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 886.77 | .006 | .400 | 42.0 | 42.0 | 4.0 | 140.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 888.41 | .006 | .400 | 43.0 | 43.0 | 4.0 | 155.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 889.80 | .004 | .250 | 44.0 | 44.0 | 6.0 | 145.0 | 70.0 | .600 | 250.0 |
| 7 | 1 | 5.00 | 891.43 | .006 | .400 | 44.0 | 44.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 893.04 | .006 | .400 | 49.0 | 49.0 | 9.0 | 175.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 894.69 | .006 | .400 | 50.0 | 50.0 | 9.0 | 160.0 | | .600 | 300.0 |

a/ Not detectable.
b/ $\times 10^{-3}$.

TABLE D-5

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 10 DATE- 12-07-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 168.0 | 0.00[a] | 10.30[b] | .20 | 894.80 | 5.1 | 18.2 | 5.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 896.12 | .004 | .250 | 42.0 | 45.0 | 5.0 | 180.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 898.14 | .010 | .650 | 41.0 | 41.0 | 11.0 | 205.0 | | .600 | 400.0 |
| 3 | 1 | 5.00 | 899.48 | .004 | .250 | 41.0 | 41.0 | 7.0 | 165.0 | 50.0 | .600 | 250.0 |
| 5 | 1 | 5.00 | 901.06 | .006 | .300 | 42.0 | 42.0 | 7.0 | 175.0 | 60.0 | .600 | 300.0 |
| 6 | 1 | 5.00 | 902.40 | .004 | .250 | 44.0 | 44.0 | 7.0 | 175.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 903.95 | .006 | .300 | 46.0 | 46.0 | 8.0 | 185.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 905.49 | .005 | .300 | 48.0 | 48.0 | 8.0 | 215.0 | 70.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 906.78 | .005 | .200 | 49.0 | 49.0 | 8.0 | 335.0 | | .600 | 300.0 |

a/ Not detectable.
b/ x $10^{-3}$.

TABLE D-6

BENZ[c]PHENANTHRENE DATA AND CALCULATED VALUES

RUN- 12 DATE- 12-08-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.35 | 0.00 | 83.0 | 0.00[a] | 27.30[b] | .20 | 908.17 | 1.1 | 22.3 | 6.7 | .859 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GFL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 909.38 | .005 | .250 | 51.0 | 54.0 | 5.0 | 360.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 910.51 | .003 | .200 | 46.0 | 46.0 | 10.0 | 330.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 911.59 | .003 | .200 | 42.0 | 43.0 | 4.0 | 220.0 | | .600 | 220.0 |
| 3 | 1 | 5.00 | 912.73 | .003 | .200 | 44.0 | 44.0 | 6.0 | 170.0 | | .600 | 220.0 |
| 5 | 1 | 5.00 | 913.88 | .004 | .150 | 40.0 | 40.0 | 10.0 | 230.0 | 50.0 | .600 | 240.0 |
| 6 | 1 | 5.00 | 915.17 | .004 | .200 | 41.0 | 41.0 | 4.0 | 190.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 916.16 | .003 | .150 | 45.0 | 42.0 | 10.0 | 310.0 | | .600 | 220.0 |

a/ Not detectable.
b/ x $10^{-3}$.

TABLE D-7

BENZ[c]PHENANTHRENE EMISSION DATA

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 40.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.31 | 29.25 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .546 | .606 | .412 |
| VM | VOL DRY GAS-METER COND | DCF | 15.57 | 16.20 | 13.89 |
| TM | AVG GAS METER TEMP | DEG.F | 57.6 | 67.1 | 68.3 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.64 | 15.98 | 13.64 |
| VW | TOTAL H2O COLLECTED | ML | 109.8 | 134.4 | 154.8 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 5.20 | 6.37 | 7.34 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| MD | MOLE FRACTION DRY GAS | | .750 | .715 | .650 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 15.0 | 17.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 7.3 | 9.2 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 2.9 | 4.1 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 74.8 | 69.5 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.69 | 31.12 |
| MW | MOLECULAR WT-STK GAS | | 27.10 | 27.07 | 26.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .008 | .006 |
| TS | AVG STACK TEMPERATURE | DEG.F | 150.0 | 155.6 | 163.8 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 8 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.31 | 29.25 |
| VS | AVG STACK GAS VELOCITY | FPM | 333 | 346 | 300 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 42 | 32 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 67 | 69 | 60 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 15.40 | 3.40 | 11.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 15.40 | 23.40 | 11.00 |
| IC | PERC IMPINGER CATCH | | 0.00 | 85.47 | 0.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | .01516 | .00328 | .01242 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .01516 | .02255 | .01242 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | .00968 | .00198 | .00671 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .00968 | .01360 | .00671 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | .00552[b] | .00117[b] | .00345[b] |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00552[b] | .00807[b] | .00345[b] |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-7 (Concluded)

| NAME | DESCRIPTION | UNITS | 9 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 35.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .357 | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 10.99 | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 45.3 | 44.3 | 44.2 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.43 | 12.49 | 8.24 |
| VW | TOTAL H2O COLLECTED | ML | 96.1 | 168.0 | 83.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 4.56 | 7.96 | 3.93 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .715 | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 16.1 | 18.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 6.4 | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 1.5 | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 76.0 | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.83 | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.18 | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .005 | .003 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.0 | 204.4 | 258.6 |
| NP | NET SAMPLING POINTS | | 7 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.65 | 29.35 |
| VS | AVG STACK GAS VELOCITY | FPM | 286 | 294 | 243 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 35 | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 57 | 59 | 49 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 0.00 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 19.80 | 10.30 | 27.30 |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 | 100.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | 0.00000 | 0.00000 | 0.00000 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .02667 | .01270 | .05101 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | 0.00000 | 0.00000 | 0.00000 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .01629 | .00613 | .02498 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | 0.00000 | 0.00000 | 0.00000 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00798[b] | .00309[c] | .01040[b] |
| FA | PERCENT EXCESS AIR | | 39 | 14 | -11 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 7.

[c] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-8

BENZ[c]PHENANTHRENE EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 40.0 |
| PH | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.31 | 29.25 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .546 | .606 | .412 |
| VM | VOL DRY GAS-METER COND | DCF | 15.57 | 16.20 | 13.89 |
| TM | AVG GAS METER TEMP | DEG.F | 57.6 | 67.1 | 68.7 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .44 | .45 | .39 |
| VW | TOTAL H2O COLLECTED | ML | 109.8 | 134.4 | 154.9 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .15 | .18 | .21 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| MD | MOLE FRACTION DRY GAS | | .750 | .715 | .650 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 15.0 | 17.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 7.3 | 4.2 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 2.9 | 4.1 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 74.8 | 69.5 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.69 | 31.17 |
| MW | MOLECULAR WT-STK GAS | | 27.10 | 27.07 | 26.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .009 | .006 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 65.5 | 68.7 | 73.2 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 8 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.31 | 29.25 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 101.4 | 105.6 | 91.5 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | 1.2 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.9 | 2.0 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 15.40 | 3.40 | 11.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 15.40 | 23.40 | 11.00 |
| IC | PERC IMPINGER CATCH | | 0.00 | 85.47 | 0.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 34.70 | 7.50 | 28.43 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 34.70 | 51.60 | 28.43 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 22.16 | 4.52 | 15.35 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 22.16 | 31.12 | 15.35 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | .00250[b] | .00053[b] | .00157[b] |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .00250[b] | .00366[b] | .00157[b] |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-8 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 35.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .357 | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 10.99 | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 45.3 | 44.1 | 44.2 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .32 | .35 | .23 |
| VW | TOTAL H2O COLLECTED | ML | 96.1 | 168.0 | 83.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .13 | .23 | .11 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .715 | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 16.1 | 18.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 6.4 | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 1.5 | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 76.0 | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.83 | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.18 | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .005 | .003 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.3 | 95.8 | 125.9 |
| NP | NET SAMPLING POINTS | | 7 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.65 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 87.1 | 89.6 | 74.0 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.0 | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 0.00 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 19.80 | 10.30 | 27.30 |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 | 100.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 0.00 | 0.00 | 0.00 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 61.03 | 29.07 | 116.72 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 0.00 | 0.00 | 0.00 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 37.27 | 14.03 | 57.16 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | 0.00000 | 0.00000 | 0.00000 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .00362[b] | .00140[c] | .00472[b] |
| EA | PERCENT EXCESS AIR | | 19 | 14 | -11 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 7.

[c] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-9

SUMMARY OF RESULTS (BENZ[c]PHENANTHRENE)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.64 | 15.98 | 13.64 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| TS | AVG STACK TEMPERATURE | DEG.F | 150.0 | 155.6 | 163.8 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 42 | 32 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 67 | 69 | 60 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 15.40 | 3.40 | 11.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | .01516 | .00328 | .01242 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | .00968 | .00198 | .00671 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | .00552[b] | .00117[b] | .00345[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 15.40 | 23.40 | 11.00 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .01516 | .02255 | .01242 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .00968 | .01360 | .00671 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00552[b] | .00807[b] | .00345[b] |
| IC | PERC IMPINGER CATCH | | 0.00 | 85.47 | 0.00 |

[a] x 10-3.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-9 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.43 | 12.49 | 8.24 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.0 | 204.4 | 258.6 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 35 | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 57 | 59 | 49 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 0.00 | 0.00 | 0.00 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 0.00000 | 0.00000 | 0.00000 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 0.00000 | 0.00000 | 0.00000 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | 0.00000 | 0.00000 | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a/] | MG | 19.80 | 10.30 | 27.30 |
| CAO | PART. LOAD-TTL,STD CN[a/] | GR/DSCF | .02667 | .01270 | .05101 |
| CAU | PART. LOAD-TTL,STK CN[a/] | GR/ACF | .01629 | .00613 | .02498 |
| CAX | PARTIC EMIS-TOTAL[a/] | LB/HR | .00798[b/] | .00309[c/] | .01040[b/] |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 | 100.00 |

a/ x $10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 7.

c/ Per stack; to obtain total for kiln, multiply by 8.

TABLE D-10

SUMMARY OF RESULTS--METRIC UNITS (BENZ[c]PHENANTHRENE)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .443 | .453 | .346 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 65.5 | 68.7 | 73.2 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | 1.2 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.9 | 2.0 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 15.40 | 3.40 | 11.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 34.70 | 7.50 | 28.43 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 22.16 | 4.52 | 15.35 |
| CAMM | PARTIC EMIS-PARTIAL[a] | KG/HR | .00250[b] | .00053[b] | .00157[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 15.40 | 23.40 | 11.00 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 34.70 | 51.60 | 28.43 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 22.16 | 31.12 | 15.35 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .00250[b] | .00366[b] | .00157[b] |
| IC | PERC IMPINGER CATCH | | 0.00 | 85.47 | 0.00 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-10 (Concluded)

| NAME | DESCRIPTION | UNITS | 11 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .324 | .354 | .233 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.3 | 95.8 | 125.9 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.0 | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| EA | PERCENT EXCESS AIR | | 39 | 14 | -11 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 0.00 | 0.00 | 0.00 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 0.00 | 0.00 | 0.00 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 0.00 | 0.00 | 0.00 |
| CAMM | PARTIC EMIS-PARTIAL | KG/HR | 0.00000 | 0.00000 | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a/] | MG | 19.80 | 10.30 | 27.30 |
| CAOM | PART. LOAD-TTL,STD CN[a/] | MG/NM3 | 61.03 | 29.07 | 116.72 |
| CAUM | PART. LOAD-TTL,STK CN[a/] | MG/M3 | 37.27 | 14.03 | 57.16 |
| CAXM | PARTIC EMIS-TOTAL[a/] | KG/HR | .00362[b/] | .00140[c/] | .00472[b/] |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 | 100.00 |

a/ x $10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 7.

c/ Per stack; to obtain total for kiln, multiply by 8.

TABLE D-11

BENZ[a]PYRENE DATA AND CALCULATED VALUES

RUN- 4 DATE- 12-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H20) | H20 COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.31 | 0.00 | 134.4 | 3.40[a] | 14.30[a] | .20 | 853.51 | 7.3 | 15.0 | 2.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H20) | DELTA H (I.H20) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 854.97 | .004 | .500 | 64.0 | 66.0 | 5.0 | 150.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 857.01 | .008 | .600 | 58.0 | 60.0 | 7.5 | 145.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 859.01 | .008 | .550 | 61.0 | 61.0 | 5.5 | 160.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 860.85 | .007 | .500 | 64.0 | 64.0 | 5.0 | 160.0 | | .600 | 320.0 |
| 5 | 1 | 5.00 | 863.15 | .011 | .700 | 68.0 | 68.0 | 12.0 | 165.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 865.45 | .011 | .700 | 72.0 | 72.0 | 9.0 | 150.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 867.35 | .006 | .600 | 73.0 | 73.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 869.71 | .011 | .700 | 75.0 | 75.0 | 13.0 | 155.0 | | .600 | 400.0 |

[a] x $10^{-3}$.

TABLE D-12

BENZ[a]PYRENE DATA AND CALCULATED VALUES

RUN- 6 DATE- 12-05-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.25 | -0.00 | 154.8 | 3.20[a/] | 7.20[a/] | .20 | 869.81 | 9.2 | 17.2 | 4.1 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 871.25 | .004 | .300 | 68.0 | 70.0 | 5.0 | 155.0 | 70.0 | .600 | 250.0 |
| 2 | 1 | 5.00 | 872.97 | .006 | .350 | 67.0 | 67.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 874.84 | .006 | .450 | 67.0 | 67.0 | 5.0 | 150.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 876.42 | .004 | .300 | 69.0 | 69.0 | 5.0 | 160.0 | | .600 | 250.0 |
| 5 | 1 | 5.00 | 878.15 | .006 | .400 | 66.0 | 67.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 879.83 | .006 | .400 | 68.0 | 68.0 | 8.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 882.05 | .010 | .700 | 70.0 | 70.0 | 10.5 | 180.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 883.70 | .006 | .400 | 70.0 | 70.0 | 7.0 | 185.0 | | .600 | 300.0 |

[a/] x $10^{-3}$.

TABLE D-13

BENZ[a]PYRENE DATA AND CALCULATED VALUES

RUN- 8 DATE- 12-06-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TURB COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 96.1 | 0.00[a] | 6.60[b] | .20 | 883.70 | 6.4 | 16.1 | 1.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GFL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 5.00 | 885.07 | .004 | .250 | 44.0 | 46.0 | 4.0 | 150.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 886.77 | .006 | .400 | 42.0 | 42.0 | 4.0 | 140.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 888.41 | .006 | .400 | 43.0 | 43.0 | 4.0 | 155.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 889.80 | .004 | .250 | 44.0 | 44.0 | 6.0 | 145.0 | 70.0 | .600 | 250.0 |
| 7 | 1 | 5.00 | 891.43 | .006 | .400 | 44.0 | 44.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 893.04 | .006 | .400 | 49.0 | 49.0 | 9.0 | 175.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 894.69 | .006 | .400 | 50.0 | 50.0 | 9.0 | 160.0 | | .600 | 300.0 |

a/ Not detectable.
b/ x $10^{-3}$.

TABLE D-14

BENZ[a]PYRENE DATA AND CALCULATED VALUES

RUN- 10 DATE- 12-07-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 168.0 | 0.00[a] | 16.80[b] | .20 | 894.80 | 5.1 | 18.2 | 5.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 896.12 | .004 | .250 | 42.0 | 45.0 | 5.0 | 180.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 898.14 | .010 | .650 | 41.0 | 41.0 | 11.0 | 205.0 | | .600 | 400.0 |
| 3 | 1 | 5.00 | 899.48 | .004 | .250 | 41.0 | 41.0 | 7.0 | 165.0 | 50.0 | .600 | 250.0 |
| 5 | 1 | 5.00 | 901.06 | .006 | .300 | 42.0 | 42.0 | 7.0 | 175.0 | 60.0 | .600 | 300.0 |
| 6 | 1 | 5.00 | 902.40 | .004 | .250 | 44.0 | 44.0 | 7.0 | 175.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 903.95 | .006 | .300 | 46.0 | 46.0 | 8.0 | 185.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 905.49 | .005 | .300 | 48.0 | 48.0 | 8.0 | 215.0 | 70.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 906.78 | .005 | .200 | 49.0 | 49.0 | 8.0 | 335.0 | | .600 | 300.0 |

a/ Not detectable.
b/ x $10^{-3}$.

TABLE D-15

BENZ[a]PYRENE DATA AND CALCULATED VALUES

RUN- 12 DATE- 12-08-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.35 | 0.00 | 83.0 | 0.00[a] | 32.20[b] | .20 | 908.17 | 1.1 | 22.3 | 4.7 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 909.38 | .005 | .250 | 51.0 | 54.0 | 5.0 | 360.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 910.51 | .003 | .200 | 46.0 | 46.0 | 10.0 | 330.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 911.59 | .003 | .200 | 42.0 | 43.0 | 4.0 | 220.0 | | .600 | 220.0 |
| 3 | 1 | 5.00 | 912.73 | .003 | .200 | 44.0 | 44.0 | 6.0 | 170.0 | | .600 | 220.0 |
| 5 | 1 | 5.00 | 913.88 | .004 | .150 | 40.0 | 40.0 | 10.0 | 230.0 | 50.0 | .600 | 240.0 |
| 6 | 1 | 5.00 | 915.17 | .004 | .200 | 41.0 | 41.0 | 4.0 | 190.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 916.16 | .003 | .150 | 45.0 | 42.0 | 10.0 | 310.0 | | .600 | 220.0 |

a/ Not detectable.
b/ x $10^{-3}$.

TABLE D-16

BENZ[a]PYRENE EMISSION DATA

| NAME | DESCRIPTION | UNITS | 4 | 6 | 8 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-04-75 | 12-05-75 | 12-06-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.25 | 29.65 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .606 | .412 | .357 |
| VM | VOL DRY GAS-METER COND | DCF | 16.20 | 13.89 | 10.99 |
| TM | AVG GAS METER TEMP | DEG.F | 67.1 | 68.3 | 45.3 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.98 | 13.64 | 11.43 |
| VW | TOTAL H2O COLLECTED | ML | 134.4 | 154.8 | 96.1 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 6.37 | 7.34 | 4.56 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 35.0 | 28.5 |
| MD | MOLE FRACTION DRY GAS | | .715 | .650 | .715 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 15.0 | 17.2 | 16.1 |
| PO2 | PERCENT O2 BY VOL, DRY | | 7.3 | 9.2 | 6.4 |
| PCO | PERCENT CO BY VOL, DRY | | 2.9 | 4.1 | 1.5 |
| PN2 | PERCENT N2 BY VOL, DRY | | 74.8 | 69.5 | 76.0 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.69 | 31.12 | 30.83 |
| MW | MOLECULAR WT-STK GAS | | 27.07 | 26.53 | 27.18 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .006 | .006 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.6 | 163.8 | 155.0 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.25 | 29.65 |
| VS | AVG STACK GAS VELOCITY | FPM | 346 | 300 | 286 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 32 | 35 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 69 | 60 | 57 |
| PERI | PERCENT ISOKINETIC | | 97.1 | 106.8 | 95.0 |
| MF | PARTICULATE WT-PARTIA[a] | MG | 3.40 | 3.20 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 14.30 | 7.20 | 6.60 |
| IC | PERC IMPINGER CATCH | | 76.22 | 55.56 | 100.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | .00328 | .00361 | 0.00000 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .01378 | .00813 | .00889 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | .00198 | .00195 | 0.00000 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .00831 | .00439 | .00543 |
| CAW | PARTIC EMIS-PARTIA[a] | LB/HR | .00117[b] | .00100[b] | 0.00000 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00493[b] | .00226[b] | .00266[c] |
| EA | PERCENT EXCESS AIR | | 42 | 64 | 39 |

a/ x $10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 8.

c/ Per stack; to obtain total for kiln, multiply by 7.

TABLE D-16 (Concluded)

| NAME | DESCRIPTION | UNITS | 10 | 12 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 44.3 | 44.2 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 12.49 | 8.24 |
| VW | TOTAL H2O COLLECTED | ML | 168.0 | 83.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 7.96 | 3.93 |
| PMOS | PERCENT MOISTURE BY VOL | | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 18.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .005 | .003 |
| TS | AVG STACK TEMPERATURE | DEG.F | 204.4 | 258.6 |
| NP | NET SAMPLING POINTS | | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.35 |
| VS | AVG STACK GAS VELOCITY | FPM | 294 | 243 |
| AS | STACK AREA | IN2 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 59 | 49 |
| PERI | PERCENT ISOKINETIC | | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 16.80 | 32.20 |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | 0.00000 | 0.00000 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .02072 | .06016 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | 0.00000 | 0.00000 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .01000 | .02946 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | 0.00000 | 0.00000 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00504[b] | .01227[c] |
| EA | PERCENT EXCESS AIR | | 14 | -11 |

[a] x $10^{-1}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

TABLE D-17

BENZ[a]PYRENE EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 4 | 6 | 8 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-04-75 | 12-05-75 | 12-06-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.25 | 29.65 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .606 | .412 | .357 |
| VM | VOL DRY GAS-METER COND | DCF | 16.20 | 13.89 | 10.99 |
| TM | AVG GAS METER TEMP | DEG.F | 67.1 | 68.3 | 45.3 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .45 | .39 | .32 |
| VW | TOTAL H2O COLLECTED | ML | 134.4 | 154.8 | 96.1 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .18 | .21 | .13 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 35.0 | 28.5 |
| MD | MOLE FRACTION DRY GAS | | .715 | .650 | .715 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 15.0 | 17.2 | 16.1 |
| PO2 | PERCENT O2 BY VOL, DRY | | 7.3 | 9.2 | 6.4 |
| PCO | PERCENT CO BY VOL, DRY | | 2.9 | 4.1 | 1.5 |
| PN2 | PERCENT N2 BY VOL, DRY | | 74.8 | 69.5 | 76.0 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.69 | 31.12 | 30.83 |
| MW | MOLECULAR WT-STK GAS | | 27.07 | 26.53 | 27.18 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .006 | .006 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.7 | 73.2 | 68.3 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.25 | 29.65 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 105.6 | 91.5 | 87.1 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | .9 | 1.0 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 2.0 | 1.7 | 1.6 |
| PERI | PERCENT ISOKINETIC | | 97.1 | 106.8 | 95.0 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 3.40 | 3.20 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 14.30 | 7.20 | 6.60 |
| IC | PERC IMPINGER CATCH | | 76.22 | 55.56 | 100.00 |
| CANM | PART. LOAD-PTL.STD CN[a] | MG/NM3 | 7.50 | 8.27 | 0.00 |
| CAOM | PART. LOAD-TTL.STD CN[a] | MG/NM3 | 31.53 | 18.61 | 20.34 |
| CATM | PART. LOAD-PTL.STK CN[a] | MG/M3 | 4.52 | 4.47 | 0.00 |
| CAUM | PART. LOAD-TTL.STK CN[a] | MG/M3 | 19.01 | 10.05 | 12.42 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | .00053[b] | .00046[b] | 0.00000 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .00224[b] | .00102[b] | .00121[c] |
| EA | PERCENT EXCESS AIR | | 42 | 64 | 39 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

TABLE D-17 (Concluded)

| NAME | DESCRIPTION | UNITS | 10 | 12 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 44.3 | 44.2 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .35 | .23 |
| VW | TOTAL H2O COLLECTED | ML | 168.0 | 83.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .23 | .11 |
| PMOS | PERCENT MOISTURE BY VOL | | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 18.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .005 | .003 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 95.8 | 125.9 |
| NP | NET SAMPLING POINTS | | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 89.6 | 74.0 |
| AS | STACK AREA | IN2 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a/] | MG | 0.00 | 0.00 |
| MT | PARTICULATE WT-TOTAL[a/] | MG | 16.80 | 32.20 |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 |
| CANM | PART. LOAD-PTL,STD CN[a/] | MG/NM3 | 0.00 | 0.00 |
| CAOM | PART. LOAD-TTL,STD CN[a/] | MG/NM3 | 47.42 | 137.67 |
| CATM | PART. LOAD-PTL,STK CN[a/] | MG/M3 | 0.00 | 0.00 |
| CAUM | PART. LOAD-TTL,STK CN[a/] | MG/M3 | 22.89 | 67.42 |
| CAWM | PARTIC EMIS-PARTIAL[a/] | KG/HR | 0.00000 | 0.00000 |
| CAXM | PARTIC EMIS-TOTAL[a/] | KG/HR | .00228[b/] | .00556[c/] |
| EA | PERCENT EXCESS AIR | | 14 | -11 |

a/ $\times 10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 8.

c/ Per stack; to obtain total for kiln, multiply by 7.

TABLE D-18

SUMMARY OF RESULTS (BENZ[a]PYRENE)

| NAME | DESCRIPTION | UNITS | 4 | 6 | 8 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-04-75 | 12-05-75 | 12-06-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.98 | 13.64 | 11.43 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 35.0 | 28.5 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.6 | 163.8 | 155.0 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 32 | 35 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 69 | 60 | 57 |
| PERI | PERCENT ISOKINETIC | | 97.1 | 106.8 | 95.0 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 3.40 | 3.20 | 0.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | .00328 | .00361 | 0.00000 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | .00198 | .00195 | 0.00000 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | .00117[b] | .00100[b] | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 14.30 | 7.20 | 6.60 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .01378 | .00813 | .00889 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .00831 | .00439 | .00543 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .00493[b] | .00226[b] | .00266[c] |
| IC | PERC IMPINGER CATCH | | 76.22 | 55.56 | 100.00 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

TABLE D-18 (Concluded)

| NAME | DESCRIPTION | UNITS | 10 | 12 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-07-75 | 12-08-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 12.49 | 8.24 |
| PMOS | PERCENT MOISTURE BY VOL | | 38.9 | 32.3 |
| TS | AVG STACK TEMPERATURE | DEG.F | 204.4 | 258.6 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 59 | 49 |
| PERI | PERCENT ISOKINETIC | | 111.8 | 100.5 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 0.00 | 0.00 |
| CAN | PART. LOAD-PTL,STD CN | GR/DSCF | 0.00000 | 0.00000 |
| CAT | PART. LOAD-PTL,STK CN | GR/ACF | 0.00000 | 0.00000 |
| CAW | PARTIC EMIS-PARTIAL | LB/HR | 0.00000 | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL[a/] | MG | 16.80 | 32.20 |
| CAO | PART. LOAD-TTL,STD CN[a/] | GR/DSCF | .02072 | .06016 |
| CAU | PART. LOAD-TTL,STK CN[a/] | GR/ACF | .01000 | .02946 |
| CAX | PARTIC EMIS-TOTAL[a/] | LB/HR | .00504[b/] | .01227[c/] |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 |

a/ x $10^{-3}$.
b/ Per stack; to obtain total for kiln, multiply by 8.
c/ Per stack; to obtain total for kiln, multiply by 7.

TABLE D-19

SUMMARY OF RESULTS--METRIC UNITS (BENZ[a]PYRENE)

| NAME | DESCRIPTION | UNITS | 4 | 6 | 8 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-04-75 | 12-05-75 | 12-06-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .453 | .386 | .324 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 35.0 | 28.5 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.7 | 73.2 | 68.3 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | .9 | 1.0 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 2.0 | 1.7 | 1.6 |
| PERI | PERCENT ISOKINETIC | | 97.1 | 106.8 | 95.0 |
| EA | PERCENT EXCESS AIR | | 42 | 64 | 39 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 3.40 | 3.20 | 0.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 7.50 | 8.27 | 0.00 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 4.52 | 4.47 | 0.00 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | .00053[b] | .00046[b] | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 14.30 | 7.20 | 6.60 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 31.53 | 18.61 | 20.34 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 19.01 | 10.05 | 12.42 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .00224[b] | .00102[b] | .00121[c] |
| IC | PERC IMPINGER CATCH | | 76.22 | 55.56 | 100.00 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

TABLE D-19 (Concluded)

| NAME | DESCRIPTION | UNITS | 10 | 12 |
|---|---|---|---|---|
| | DATE OF RUN | | 12-07-75 | 12-08-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .354 | .233 |
| PMOS | PERCENT MOISTURE BY VOL | | 38.9 | 32.3 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 95.8 | 125.9 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 111.8 | 100.5 |
| EA | PERCENT EXCESS AIR | | 14 | -11 |
| PARTICULATES -- PARTIAL CATCH | | | | |
| MF | PARTICULATE WT-PARTIAL | MG | 0.00 | 0.00 |
| CANM | PART. LOAD-PTL,STD CN | MG/NM3 | 0.00 | 0.00 |
| CATM | PART. LOAD-PTL,STK CN | MG/M3 | 0.00 | 0.00 |
| CAWM | PARTIC EMIS-PARTIAL | KG/HR | 0.00000 | 0.00000 |
| PARTICULATES -- TOTAL CATCH | | | | |
| MT | PARTICULATE WT-TOTAL[a/] | MG | 16.80 | 32.20 |
| CAOM | PART. LOAD-TTL,STD CN[a/] | MG/NM3 | 47.42 | 137.67 |
| CAUM | PART. LOAD-TTL,STK CN[a/] | MG/M3 | 22.89 | 67.42 |
| CAXM | PARTIC EMIS-TOTAL[a/] | KG/HR | .00228[b/] | .00556[c/] |
| IC | PERC IMPINGER CATCH | | 100.00 | 100.00 |

a/ x $10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 8.

c/ Per stack; to obtain total for kiln, multiply by 7.

TABLE D-20

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 2 DATE- 12-03-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.31 | 0.00 | 109.8 | 345.00[a] | 376.00[a] | .20 | 837.66 | 9.2 | 11.0 | 1.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 838.98 | .005 | .270 | 43.0 | 43.0 | 8.5 | 140.0 | | .600 | 260.0 |
| 2 | 1 | 5.00 | 840.69 | .006 | .400 | 49.0 | 49.0 | 5.0 | 145.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 842.82 | .009 | .650 | 53.0 | 53.0 | 5.0 | 130.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 845.03 | .009 | .700 | 58.0 | 60.0 | 6.0 | 140.0 | | .600 | 350.0 |
| 5 | 1 | 5.00 | 847.27 | .011 | .700 | 62.0 | 62.0 | 9.0 | 160.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 849.49 | .011 | .650 | 64.0 | 64.0 | 7.0 | 155.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 851.22 | .004 | .450 | 65.0 | 66.0 | 12.0 | 165.0 | | .600 | 250.0 |
| 8 | 1 | 5.00 | 853.23 | .008 | .550 | 65.0 | 65.0 | 12.0 | 165.0 | | .600 | 350.0 |

[a] x $10^{-3}$.

TABLE D-21

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 4 DATE- 12-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.31 | 0.00 | 134.4 | 143.00[a] | 213.00[a] | .20 | 853.51 | 7.3 | 15.0 | 2.9 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 854.97 | .004 | .500 | 64.0 | 66.0 | 5.0 | 150.0 | | .600 | 250.0 |
| 2 | 1 | 5.00 | 857.01 | .008 | .600 | 58.0 | 60.0 | 7.5 | 145.0 | | .600 | 350.0 |
| 4 | 1 | 5.00 | 859.01 | .008 | .550 | 61.0 | 61.0 | 5.5 | 160.0 | | .600 | 350.0 |
| 3 | 1 | 5.00 | 860.85 | .007 | .500 | 64.0 | 64.0 | 5.0 | 160.0 | | .600 | 320.0 |
| 5 | 1 | 5.00 | 863.15 | .011 | .700 | 68.0 | 68.0 | 12.0 | 165.0 | | .600 | 400.0 |
| 6 | 1 | 5.00 | 865.45 | .011 | .700 | 72.0 | 72.0 | 9.0 | 150.0 | | .600 | 400.0 |
| 7 | 1 | 5.00 | 867.35 | .006 | .600 | 73.0 | 73.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 869.71 | .011 | .700 | 75.0 | 75.0 | 13.0 | 155.0 | | .600 | 400.0 |

[a] x $10^{-3}$.

TABLE D-22

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 6 DATE- 12-05-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PEPC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 29.25 | -0.00 | 154.8 | 69.00[a] | 105.00[a] | .20 | 869.81 | 9.2 | 17.2 | 4.1 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 871.25 | .004 | .300 | 68.0 | 70.0 | 5.0 | 155.0 | 70.0 | .600 | 250.0 |
| 2 | 1 | 5.00 | 872.97 | .006 | .350 | 67.0 | 67.0 | 5.0 | 155.0 | | .600 | 300.0 |
| 4 | 1 | 5.00 | 874.84 | .006 | .450 | 67.0 | 67.0 | 5.0 | 150.0 | | .600 | 300.0 |
| 3 | 1 | 5.00 | 876.42 | .004 | .300 | 69.0 | 69.0 | 5.0 | 160.0 | | .600 | 250.0 |
| 5 | 1 | 5.00 | 878.15 | .006 | .400 | 66.0 | 67.0 | 7.0 | 160.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 879.83 | .006 | .400 | 68.0 | 68.0 | 8.0 | 165.0 | | .600 | 300.0 |
| 7 | 1 | 5.00 | 882.05 | .010 | .700 | 70.0 | 70.0 | 10.5 | 180.0 | | .600 | 400.0 |
| 8 | 1 | 5.00 | 883.70 | .006 | .400 | 70.0 | 70.0 | 7.0 | 185.0 | | .600 | 300.0 |

[a] x 10-3.

TABLE D-23

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 8 DATE- 12-06-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 96.1 | 0.00[a] | 191.00[b] | .20 | 883.70 | 6.4 | 16.1 | 1.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 5.00 | 885.07 | .004 | .250 | 44.0 | 46.0 | 4.0 | 150.0 | | .600 | 250.0 |
| 3 | 1 | 5.00 | 886.77 | .006 | .400 | 42.0 | 42.0 | 4.0 | 140.0 | | .600 | 300.0 |
| 5 | 1 | 5.00 | 888.41 | .006 | .400 | 43.0 | 43.0 | 4.0 | 155.0 | | .600 | 300.0 |
| 6 | 1 | 5.00 | 889.80 | .004 | .250 | 44.0 | 44.0 | 6.0 | 145.0 | 70.0 | .600 | 250.0 |
| 7 | 1 | 5.00 | 891.43 | .006 | .400 | 44.0 | 44.0 | 5.0 | 160.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 893.04 | .006 | .400 | 49.0 | 49.0 | 9.0 | 175.0 | | .600 | 300.0 |
| 1 | 1 | 5.00 | 894.69 | .006 | .400 | 50.0 | 50.0 | 9.0 | 160.0 | | .600 | 300.0 |

a/ Not detectable.
b/ x 10-3.

TABLE D-24

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 10 DATE- 12-07-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.65 | 0.00 | 168.0 | 160.00[a] | 416.00[a] | .20 | 894.80 | 5.1 | 18.2 | 5.5 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 896.12 | .004 | .250 | 42.0 | 45.0 | 5.0 | 180.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 898.14 | .010 | .650 | 41.0 | 41.0 | 11.0 | 205.0 | | .600 | 400.0 |
| 3 | 1 | 5.00 | 899.48 | .004 | .250 | 41.0 | 41.0 | 7.0 | 165.0 | 50.0 | .600 | 250.0 |
| 5 | 1 | 5.00 | 901.06 | .006 | .300 | 42.0 | 42.0 | 7.0 | 175.0 | 60.0 | .600 | 300.0 |
| 6 | 1 | 5.00 | 902.40 | .004 | .250 | 44.0 | 44.0 | 7.0 | 175.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 903.95 | .006 | .300 | 46.0 | 46.0 | 8.0 | 185.0 | | .600 | 300.0 |
| 8 | 1 | 5.00 | 905.49 | .005 | .300 | 48.0 | 48.0 | 8.0 | 215.0 | 70.0 | .600 | 300.0 |
| 2 | 1 | 5.00 | 906.78 | .005 | .200 | 49.0 | 49.0 | 8.0 | 335.0 | | .600 | 300.0 |

[a] $\times 10^{3}$.

TABLE D-25

POM-LIKE MATERIAL DATA AND CALCULATED VALUES

RUN- 12 DATE- 12-08-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.0 | 29.35 | 0.00 | 83.0 | 448.00[a/] | 795.00[a/] | .20 | 908.17 | 1.1 | 22.3 | 6.7 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 909.38 | .005 | .250 | 51.0 | 54.0 | 5.0 | 360.0 | | .600 | 300.0 |
| 2 | 1 | 5.00 | 910.51 | .003 | .200 | 46.0 | 46.0 | 10.0 | 330.0 | | .600 | 250.0 |
| 4 | 1 | 5.00 | 911.59 | .003 | .200 | 42.0 | 43.0 | 4.0 | 220.0 | | .600 | 220.0 |
| 3 | 1 | 5.00 | 912.73 | .003 | .200 | 44.0 | 44.0 | 6.0 | 170.0 | | .600 | 220.0 |
| 5 | 1 | 5.00 | 913.88 | .004 | .150 | 40.0 | 40.0 | 10.0 | 230.0 | 50.0 | .600 | 240.0 |
| 6 | 1 | 5.00 | 915.17 | .004 | .200 | 41.0 | 41.0 | 4.0 | 190.0 | | .600 | 250.0 |
| 7 | 1 | 5.00 | 916.16 | .003 | .150 | 45.0 | 42.0 | 10.0 | 310.0 | | .600 | 220.0 |

[a/] x $10^{-3}$.

TABLE D-26

POM-LIKE MATERIAL EMISSION DATA

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 40.0 |
| PR | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.31 | 29.25 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .546 | .606 | .412 |
| VM | VOL DRY GAS-METER COND | DCF | 15.57 | 16.20 | 13.89 |
| TM | AVG GAS METER TEMP | DEG.F | 57.6 | 67.1 | 68.3 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.64 | 15.98 | 13.64 |
| VW | TOTAL H2O COLLECTED | ML | 109.8 | 134.4 | 154.8 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 5.20 | 6.37 | 7.34 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| MD | MOLE FRACTION DRY GAS | | .750 | .715 | .650 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 15.0 | 17.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 7.3 | 9.2 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 2.9 | 4.1 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 74.8 | 69.5 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.69 | 31.12 |
| MW | MOLECULAR WT-STK GAS | | 27.10 | 27.07 | 26.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .008 | .006 |
| TS | AVG STACK TEMPERATURE | DEG.F | 150.0 | 155.6 | 163.6 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 8 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.31 | 29.25 |
| VS | AVG STACK GAS VELOCITY | FPM | 333 | 346 | 300 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 42 | 32 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 67 | 69 | 60 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.6 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 345.00 | 3.00 | 69.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 376.00 | 213.00 | 105.00 |
| IC | PERC IMPINGER CATCH | | 8.24 | 32.86 | 34.29 |
| CAN | PART. LOAD-PTL.STD CN[a] | GR/DSCF | .33970 | .13781 | .07792 |
| CAO | PART. LOAD-TTL.STD CN[a] | GR/DSCF | .37022 | .20526 | .11858 |
| CAT | PART. LOAD-PTL.STK CN[a] | GR/ACF | .21694 | .08309 | .04208 |
| CAU | PART. LOAD-TTL.STK CN[a] | GR/ACF | .23643 | .12377 | .06404 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | .12366[b] | .04932[b] | .02164[b] |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .13477[b] | .07347[b] | .03294[b] |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-26 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 35.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .357 | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 10.99 | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 45.3 | 44.3 | 44.2 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.43 | 12.49 | 8.24 |
| VW | TOTAL H2O COLLECTED | ML | 96.1 | 168.0 | 83.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 4.56 | 7.96 | 3.93 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .715 | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 16.1 | 16.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 6.4 | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 1.5 | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 76.0 | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.83 | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.18 | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .005 | .003 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.0 | 204.4 | 258.6 |
| NP | NET SAMPLING POINTS | | 7 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.65 | 29.35 |
| VS | AVG STACK GAS VELOCITY | FPM | 286 | 294 | 243 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 35 | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 57 | 59 | 49 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 160.00 | 448.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 191.00 | 416.00 | 795.00 |
| IC | PERC IMPINGER CATCH | | 100.00 | 61.54 | 43.65 |
| CAN | PART. LOAD-PTL.STD CN[a] | GR/DSCF | 0.00000 | .19734 | .83702 |
| CAO | PART. LOAD-TTL.STD CN[a] | GR/DSCF | .25726 | .51308 | 1.48533 |
| CAT | PART. LOAD-PTL.STK CN[a] | GR/ACF | 0.00000 | .09525 | .40994 |
| CAU | PART. LOAD-TTL.STK CN[a] | GR/ACF | .15711 | .24766 | .72746 |
| CAR | PARTIC EMIS-PARTIAL[a] | LB/HR | 0.00000 | .04797[c] | .17067[b] |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .07695[b] | .12472[c] | .30286[b] |
| EA | PERCENT EXCESS AIR | | 39 | 14 | -11 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 7.

[c] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-27

POM-LIKE MATERIAL EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 40.0 | 40.0 | 40.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.31 | 29.31 | 29.25 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .546 | .606 | .412 |
| VM | VOL DRY GAS-METER COND | DCF | 15.57 | 16.20 | 13.89 |
| TM | AVG GAS METER TEMP | DEG.F | 57.6 | 67.1 | 68.3 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .44 | .45 | .39 |
| VW | TOTAL H2O COLLECTED | ML | 109.8 | 134.4 | 154.8 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .15 | .18 | .21 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| MD | MOLE FRACTION DRY GAS | | .750 | .715 | .650 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 11.0 | 15.0 | 17.2 |
| PO2 | PERCENT O2 BY VOL, DRY | | 9.2 | 7.3 | 9.2 |
| PCO | PERCENT CO BY VOL, DRY | | 1.9 | 2.9 | 4.1 |
| PN2 | PERCENT N2 BY VOL, DRY | | 77.9 | 74.8 | 69.5 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.13 | 30.69 | 31.12 |
| MW | MOLECULAR WT-STK GAS | | 27.10 | 27.07 | 26.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .008 | .008 | .006 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 65.5 | 68.7 | 73.2 |
| NP | NET SAMPLING POINTS | | 8 | 8 | 8 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.31 | 29.31 | 29.25 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 101.4 | 105.6 | 91.5 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | 1.2 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.9 | 2.0 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 345.00 | 143.00 | 69.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 376.00 | 213.00 | 105.00 |
| IC | PERC IMPINGER CATCH | | 8.24 | 32.86 | 34.29 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 777.34 | 315.34 | 178.32 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 847.19 | 469.71 | 271.35 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 496.43 | 190.15 | 96.30 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 541.04 | 283.23 | 146.55 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | .05609[b] | .02237[b] | .00982[b] |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .06113[b] | .03332[b] | .01494[b] |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-27 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| DN | PROBE TIP DIAMETER | IN | .600 | .600 | .600 |
| TT | NET TIME OF RUN | MIN | 35.0 | 40.0 | 35.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.65 | 29.65 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .357 | .312 | .193 |
| VM | VOL DRY GAS-METER COND | DCF | 10.99 | 11.98 | 7.99 |
| TM | AVG GAS METER TEMP | DEG.F | 45.3 | 44.3 | 44.2 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .32 | .35 | .23 |
| VW | TOTAL H2O COLLECTED | ML | 96.1 | 168.0 | 83.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .13 | .23 | .11 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| MD | MOLE FRACTION DRY GAS | | .715 | .611 | .677 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 16.1 | 18.2 | 22.3 |
| PO2 | PERCENT O2 BY VOL, DRY | | 6.4 | 5.1 | 1.1 |
| PCO | PERCENT CO BY VOL, DRY | | 1.5 | 5.5 | 6.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 76.0 | 71.2 | 69.9 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.83 | 31.12 | 31.61 |
| MW | MOLECULAR WT-STK GAS | | 27.18 | 26.01 | 27.21 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .006 | .005 | .003 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.3 | 95.8 | 125.9 |
| NP | NET SAMPLING POINTS | | 7 | 8 | 7 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.65 | 29.65 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 87.1 | 89.6 | 74.0 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.0 | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 160.00 | 448.00 |
| MT | PARTICULATE WT-TOTAL[a] | MG | 191.00 | 416.00 | 795.00 |
| IC | PERC IMPINGER CATCH | | 100.00 | 61.54 | 43.65 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 0.00 | 451.57 | 1915.38 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 588.70 | 1174.09 | 3398.95 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 0.00 | 217.97 | 938.08 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 359.52 | 566.73 | 1664.67 |
| CAWM | PARTIC EMIS-PARTIAL[a] | KG/HR | 0.00000 | .02176[c] | .07741[b] |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .03491[b] | .05657[c] | .13738[b] |
| EA | PERCENT EXCESS AIR | | 39 | 14 | -11 |

[a] $\times 10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 7.

[c] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-28

SUMMARY OF RESULTS (POM-LIKE MATERIAL)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 15.64 | 15.98 | 13.64 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| TS | AVG STACK TEMPERATURE | DEG.F | 150.0 | 155.6 | 163.8 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 42 | 42 | 32 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 67 | 69 | 60 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 345.00 | 143.00 | 69.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | .33970 | .13781 | .07792 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | .21694 | .08309 | .04208 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | .12366[b] | .04932[b] | .02164[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 376.00 | 213.00 | 105.00 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .37022 | .20526 | .11858 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .23643 | .12377 | .06404 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .13477[b] | .07347[b] | .03294[b] |
| IC | PERC IMPINGER CATCH | | 8.24 | 32.86 | 34.29 |

[a] x 10-3.

[b] Per stack; to obtain total for kiln, multiply by 8.

TABLE D-28 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 11.43 | 12.49 | 8.24 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| TS | AVG STACK TEMPERATURE | DEG.F | 155.0 | 204.4 | 258.6 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 35 | 28 | 24 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 57 | 59 | 49 |
| PEPI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 160.00 | 448.00 |
| CAN | PART. LOAD-PTL,STD CN[a] | GR/DSCF | 0.00000 | .19734 | .83702 |
| CAT | PART. LOAD-PTL,STK CN[a] | GR/ACF | 0.00000 | .09525 | .40994 |
| CAW | PARTIC EMIS-PARTIAL[a] | LB/HR | 0.00000 | .04797[b] | .17067[c] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 191.00 | 416.00 | 795.00 |
| CAO | PART. LOAD-TTL,STD CN[a] | GR/DSCF | .25726 | .51308 | 1.48533 |
| CAU | PART. LOAD-TTL,STK CN[a] | GR/ACF | .15711 | .24766 | .72746 |
| CAX | PARTIC EMIS-TOTAL[a] | LB/HR | .07695[c] | .12472[b] | .30286[c] |
| IC | PERC IMPINGER CATCH | | 100.00 | 61.54 | 43.65 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

TABLE D-29

SUMMARY OF RESULTS--METRIC UNITS (POM-LIKE MATERIAL)

| NAME | DESCRIPTION | UNITS | 2 | 4 | 6 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-03-75 | 12-04-75 | 12-05-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .443 | .453 | .386 |
| PMOS | PERCENT MOISTURE BY VOL | | 25.0 | 28.5 | 35.0 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 65.5 | 68.7 | 73.2 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.2 | 1.2 | .9 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.9 | 2.0 | 1.7 |
| PERI | PERCENT ISOKINETIC | | 93.5 | 97.1 | 106.8 |
| EA | PERCENT EXCESS AIR | | 67 | 42 | 64 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 345.00 | 143.00 | 69.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 777.34 | 315.34 | 178.32 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 496.43 | 190.15 | 96.30 |
| CAMM | PARTIC EMIS-PARTIAL[a] | KG/HR | .05609[b] | .02237[b] | .00982[b] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 376.00 | 213.00 | 105.00 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 847.19 | 469.71 | 271.35 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 541.04 | 283.23 | 146.55 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .06113[b] | .03332[b] | .01494[b] |
| IC | PERC IMPINGER CATCH | | 8.24 | 32.86 | 34.29 |

a/ x $10^{-3}$.

b/ Per stack; to obtain total for kiln, multiply by 8.

TABLE D-29 (Concluded)

| NAME | DESCRIPTION | UNITS | 8 | 10 | 12 |
|---|---|---|---|---|---|
| | DATE OF RUN | | 12-06-75 | 12-07-75 | 12-08-75 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .324 | .354 | .233 |
| PMOS | PERCENT MOISTURE BY VOL | | 28.5 | 38.9 | 32.3 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 68.3 | 95.8 | 125.9 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | 1.0 | .8 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.6 | 1.7 | 1.4 |
| PERI | PERCENT ISOKINETIC | | 95.0 | 111.8 | 100.5 |
| EA | PERCENT EXCESS AIR | | 39 | 14 | -11 |
| PARTICULATES -- PARTIAL CATCH | | | | | |
| MF | PARTICULATE WT-PARTIAL[a] | MG | 0.00 | 160.00 | 448.00 |
| CANM | PART. LOAD-PTL,STD CN[a] | MG/NM3 | 0.00 | 451.57 | 1915.38 |
| CATM | PART. LOAD-PTL,STK CN[a] | MG/M3 | 0.00 | 217.97 | 938.08 |
| CAMM | PARTIC EMIS-PARTIAL[a] | KG/HR | 0.00000 | .02176[b] | .07741[c] |
| PARTICULATES -- TOTAL CATCH | | | | | |
| MT | PARTICULATE WT-TOTAL[a] | MG | 141.00 | 416.00 | 795.00 |
| CAOM | PART. LOAD-TTL,STD CN[a] | MG/NM3 | 588.70 | 1174.09 | 3398.95 |
| CAUM | PART. LOAD-TTL,STK CN[a] | MG/M3 | 359.52 | 566.73 | 1664.67 |
| CAXM | PARTIC EMIS-TOTAL[a] | KG/HR | .03491[c] | .05657[b] | .13738[c] |
| IC | PERC IMPINGER CATCH | | 100.00 | 61.54 | 43.65 |

[a] x $10^{-3}$.

[b] Per stack; to obtain total for kiln, multiply by 8.

[c] Per stack; to obtain total for kiln, multiply by 7.

APPENDIX E

FLUE GAS COMBUSTION COMPUTATIONS

The computations that follow are based on data found in the Handbook of Chemistry and Physics, 23rd Edition[5] and Lange's Handbook of Chemistry[6] and assumptions made as noted.

A long chain aliphatic hydrocarbon, Bryonane ($C_{20}H_{42}$, mol wt 282), has been taken to represent the tar and oil fraction of the flue gas stream. A mole of any referenced gas is assumed to occupy 0.79 cu ft. A theoretical flame temperature of 3790°F (2090°C) based on several natural gas streams[5] was used for combustion of the flue gas stream. This natural gas then requires 16 cu ft air per cubic foot natural gas[5] in addition to that required for combustion of the flue gas stream, and will produce 24,500 cal/cu ft natural gas.

Heats of vaporization of water are as follows:[5,6]

| Temperature (°C) | Heat of vaporization (cal/g) |
|---|---|
| 60 | 563.2 |
| 70 | 557.5 |
| 95 | 542.7 |
| 145 | 507.3 |

Specific heats of the various compounds are as follows:[6]

| Compound | Specific heat (cal/g/°C) |
|---|---|
| Air | 0.24 |
| Carbon dioxide | 0.20 |
| Carbon monoxide | 0.25 |
| Nitrogen | 0.25 |
| Oxygen | 0.22 |
| Water | 0.48 |

Computations to determine the net heat available from the flue gas stream are based on the heats of combustion of the water and tar and oil fractions less the heat of vaporization of the water.

Computations to determine the air fuel ratio (amount of air to be added per amount of flue gas to allow combustion) are based on stoichiometric combustion of the given amount of $C_{20}H_{42}$ available in each sample.

Calculations to determine the amount of natural gas needed for combustion of the flue gas are based on raising the gas stream and additional air from the stack temperature to the flame temperature. For the water fraction this includes the heat of vaporization.

These values must be taken as approximate or "ball-park" estimates. The positive heat of combustion for the water fraction indicates the presence of entrained volatile organics. The tar and oil fraction is composed of many constituents which may not be accurately represented by $C_{20}H_{42}$. Some constituents may have passed through the sampling train without entrapment or have been lost during sample recovery. Any or all of these factors may contribute to errors in the calculations.

<u>December 4</u>

Net heat available from flue gas stream:

Water fraction: (296 cal/g) (8.4 g) = 2,486.4 cal
(-557.5 cal/g) (8.4 g) = -4,681.0 cal

Tar and oil fraction: (1,185 cal/g) (0.6 g) = 711.0 cal

| | |
|---|---|
| Net | 2,486.4 cal |
| + | 711.0 cal |
| | 3,197.4 cal |
| | -4,683.0 cal |
| | -1,485.6 cal |

Air/fuel ratio:

0.6 g $C_{20}H_{42}$ (mol wt 282) = 0.002 mole

| | % by Volume | Volume (cu ft) | Moles |
|---|---|---|---|
| $H_2O$ | 30.5 | 0.2562 | 0.47 |
| $CO_2$ | 15 (of 69.5) | 0.08757 | 0.11 |
| $O_2$ | 7.3 | 0.0426174 | 0.05 |
| CO | 2.9 | 0.0169302 | 0.02 |
| $N_2$ | 74.8 | 0.4366824 | 0.55 |
| | | 0.84 | |

$$0.002\ C_{20}H_{42} + 0.061\ O_2 \longrightarrow 0.04\ CO_2 + 0.042\ H_2O$$

0.061 mole $O_2$ required
0.05 mole $O_2$ available in flue gas
0.011 mole $O_2$ additional required

$$\frac{0.011 \text{ mole } O_2}{0.002 \text{ mole fuel}} = 5.5$$

$$\frac{\text{mole air}}{\text{mole fuel}} = \frac{\text{volume air}}{\text{volume fuel}} = \text{air/fuel ratio} = (5.5)\left(\frac{1}{0.21}\right) = 26.2$$

Requires 26.2 cu ft air to combust 1 cu ft flue gas

Flue gas combustion:

Stack temperature = 70°C  $\Delta T = 2090°C - 70°C = 2020°C$

| Constituent | Moles | Specific heat (cal/g/°C) | Heat required per volume stack gas sampled (cal) | Heat required per cu ft stack gas (cal) |
|---|---|---|---|---|
| $CO_2$ | 0.11 | 0.20 | 1,955 | 2,328 |
| $O_2$ | 0.05 | 0.22 | 711 | 846 |
| CO | 0.02 | 0.25 | 283 | 337 |
| $N_2$ | 0.55 | 0.25 | 7,777 | 9,258 |
| $H_2O$ | 0.47 | 0.48 | 8,801 | 9,620 |
| (100°C to 2090°C = $\Delta T$ = 1990°C) | | | | 22,389 |
| Combustion air | 0.05 | 0.24 | 698 | 831 |
| Heat of vaporization | | | 4,683 | 5,575 |
| | | | Heat required | 28,795 |
| | Water fraction | | 2,486 | 2,690 |
| | Tar and oil fraction | | 711 | 846 |
| | | | Net heat available | 3,806 |
| | | | Net heat required | 24,989 |

Thus, 1.02 cu ft natural gas required per cubic foot flue gas and approximately 42 cu ft air total

December 6

Net heat available:

Water fraction: (227 cal/g) (4.6 g) = 1,044.2 cal
(-557.5 cal/g) (4.6 g) = 2,564.5 cal

Tar and oil fraction: (7,256 cal/g) (0.6 g) = 4,353.6 cal

Net: 42,833.3 cal

Air/fuel ratio:

0.002 mole $C_{20}H_{42}$
0.05 mole $O_2$

$$0.002\ C_{20}H_{42} + 0.061\ O_2 \longrightarrow 0.04\ CO_2 + 0.042\ H_2O$$

0.011 mole $O_2$ required

$$\frac{0.011 \text{ mole } O_2}{0.002 \text{ mole fuel}}$$

$$\text{Air/fuel ratio} = \frac{5.5}{0.21} = 26.2$$

Flue gas combustion:

| Constituent | Moles | Specific heat (cal/g/°C) | Heat required per cu ft stack gas (cal) |
|---|---|---|---|
| $CO_2$ | 0.13 | 0.20 | 2,458 |
| $O_2$ | 0.05 | 0.22 | 756 |
| CO | 0.01 | 0.25 | 150 |
| $N_2$ | 0.63 | 0.25 | 9,477 |
| $H_2O$ | 0.26 | 0.48 | 4,756 |
| | | | 17,597 |
| Combustion air | 0.05 | 0.24 | 743 |
| Heat of vaporization | | | 2,728 |
| | | Heat required | 21,068 |
| | | Water fraction | 1,111 |
| | | Tar and oil fraction | 4,631 |
| | | Net heat available | 5,742 |
| | | Net heat required | 15,326 |

Requires 0.91 cu ft natural gas per cubic foot flue gas and approximately 30 cu ft air total

December 7

Net heat available:

Water fraction: (153 cal/g) (18.3 g) = 2,491.9 cal
(-542.7 cal/g) (16.1 g) = -8,846.01 cal

Tar and oil fraction: (7,097 cal/g) (1.2 g) = 8,516.4 cal

Net: +2,164.3 cal

Air/fuel ratio:

0.084 mole $C_{20}H_{42}$
0.08 mole $O_2$

$$0.084\ C_{20}H_{42} + 0.122\ O_2 \longrightarrow 0.08\ CO_2 + 0.084\ H_2O$$

0.042 mole $O_2$ required

$$\frac{0.042 \text{ mole } O_2}{0.084 \text{ mole fuel}} = 10.5$$

Air/fuel ratio = 50

Flue gas combustion:

| Constituent | Moles | Specific heat (cal/g/°C) | Heat required per cu ft stack gas (cal) |
|---|---|---|---|
| $CO_2$ | 0.30 | 0.20 | 2,801 |
| $O_2$ | 0.08 | 0.22 | 598 |
| CO | 0.04 | 0.25 | 669 |
| $N_2$ | 1.16 | 0.25 | 8,617 |
| $H_2O$ | 0.91 | 0.48 | 8,322 |
| | | | 21,007 |
| Combustion air | 0.20 | 0.24 | 1,467 |
| Heat of vaporization | | | 4,705 |
| | | Heat required | 27,179 |
| | | Water fraction | 1,326 |
| | | Tar and oil fraction | 4,530 |
| | | Net heat available | 5,856 |
| | | Net heat required | 21,323 |

Requires 0.87 cu ft natural gas per cubic foot flue gas and approximately 64 cu ft air total

December 8 - First Run

Net heat available:

Water fraction: (173 cal/g) (11.0 g) = 1,903 cal
(-507.3 cal/g) (11.0 g) = -5,580.3 cal

Tar and oil fraction: (8,877 cal/g) (0.6 g) = 5,326.2 cal

Net: +1,648.9 cal

Air/fuel ratio:

0.002 mole $C_{20}H_{42}$
0.02 mole $O_2$

$$0.002\ C_{20}H_{42} + 0.061\ O_2 \longrightarrow 0.04\ CO_2 + 0.042\ H_2O$$

0.041 mole $O_2$ required

$$\frac{0.041 \text{ mole } O_2}{0.002 \text{ mole fuel}} = 20.5$$

Air/fuel ratio = 97.6

Flue gas combustion:

| Constituent | Moles | Specific heat (cal/g/°C) | Heat required per cu ft stack gas (cal) |
|---|---|---|---|
| $CO_2$ | 0.48 | 0.20 | 3,197 |
| $O_2$ | 0.02 | 0.22 | 107 |
| CO | 0.15 | 0.25 | 795 |
| $N_2$ | 1.52 | 0.25 | 8,052 |
| $H_2O$ | 0.61 | 0.48 | 4,801 |
| | | | 16,232 |
| Combustion air | 0.20 | 0.24 | 1,046 |
| Heat of vaporization | | | 2,171 |
| | | Heat required | 19,449 |
| | | Water fraction | 740 |
| | | Tar and oil fraction | 2,072 |
| | | Net heat available | 2,812 |
| | | Net heat required | 16,637 |

Requires 0.68 cu ft natural gas per cubic foot flue gas and approximately 109 cu ft air total

December 8 - Second Test

Net heat available:

Water fraction: (855 cal/g) (11.8 g) = 10,089 cal
(-507.3 cal/g) (11.8 g) = -5,986.14 cal

Tar and oil fraction: (4,715 cal/g) (0.6 g) = 2,829 cal

Net: +6,931.9 cal

Air/fuel ratio:

0.002 mole $C_{20}H_{42}$
0.02 mole $O_2$

$$0.002\ C_{20}H_{42} + 0.061\ O_2 \longrightarrow 0.04\ CO_2 + 0.042\ H_2O$$

0.041 mole $O_2$ required

$$\frac{0.041 \text{ mole } O_2}{0.002 \text{ mole fuel}} = 20.5$$

Air/fuel ratio = 97.6

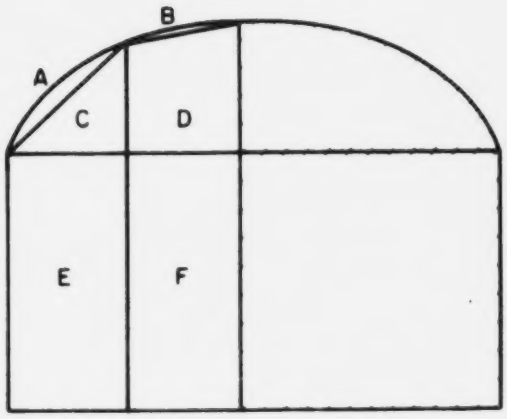
Flue gas combustion:

| Constituent | Moles | Specific heat (cal/g/°C) | Heat required per cu ft stack gas (cal) |
|---|---|---|---|
| $CO_2$ | 0.48 | 0.20 | 3,260 |
| $O_2$ | 0.02 | 0.22 | 109 |
| CO | 0.14 | 0.25 | 756 |
| $N_2$ | 1.49 | 0.25 | 8,050 |
| $H_2O$ | 0.66 | 0.48 | 4,503 |
| | | | 16,678 |
| Combustion air | 0.20 | 0.24 | 2,134 |
| Heat of vaporization | | | 2,375 |
| | | Heat required | 21,187 |
| | | Water fraction | 4,004 |
| | | Tar and oil fraction | 1,123 |
| | | Net heat available | 5,127 |
| | | Net heat required | 16,060 |

Requires 0.66 cu ft natural gas per cubic foot flue gas and approximately 108 cu ft air total

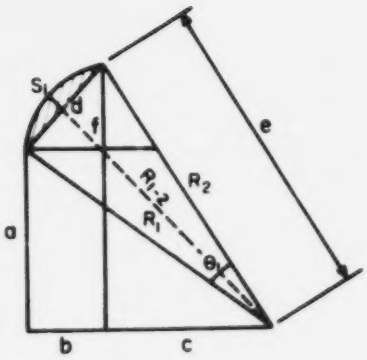
APPENDIX F

COMPUTATION OF KILN VOLUME




All units in inches unless otherwise noted

Area A =




a = 84
b = 60
c = 60

$$R_1 = \sqrt{(a)^2 + (b + c)^2} = \sqrt{(84)^2 + (120)^2}$$

$$= 146.4786674$$

$$a + f = 126$$

$$f = 126 - 84 = 42$$

$$R_2 = \sqrt{(a + f)^2 + (c)^2} = \sqrt{(126)^2 + (60)^2}$$

$$= 139.5564402$$

$$R_{1-2} = \frac{R_1 + R_2}{2} = 143.0175538$$

$$d = \sqrt{(b)^2 + (f)^2} = \sqrt{(60)^2 + (42)^2}$$

$$= 73.2393369$$

$$e = 1/2\sqrt{4(R_{1-2})^2 - (d)^2} = 1/2$$

$$\sqrt{(4)\ (143)^2 - (73)^2} = 138.2498488$$

$$\theta_1 = 2 \text{ arc sin } \left[\frac{d}{(2)\ (R_{1-2})}\right]$$

$$= 2 \text{ arc sin } \left[\frac{73}{(2)\ (143)}\right]$$

$$\theta_1 = 0.5178678409 \text{ radians}$$

$$S_1 = (R_{1-2})\ (\theta_1) = (143)\ (0.518) =$$

$$= 74.0641918$$

Area A = 233.576 sq in.

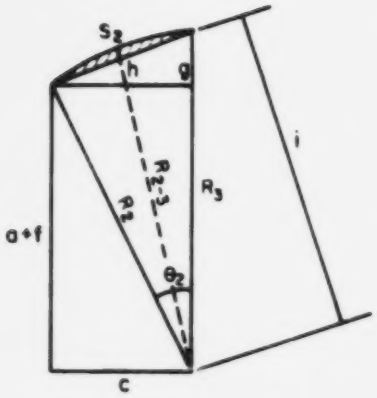
= 1.622 sq ft

Area A = $1/2\ [(R_{1-2})\ (S_1) - (d)\ (e)]$

$= 1/2\ [(143)\ (74) - (73)\ (138)]$

$= 231.5763633$

Area B:




a+f = 126
c = 60
$R_3$ = 138
$R_2$ = 139.5564402

$$R_{2-3} = \frac{R_1 + R_2}{2} = 138.7782201$$

$$g = R_3 - (a + f) = 138 - (126) = 12$$

$$h = \sqrt{g^2 + c^2} = \sqrt{(12)^2 + (60)^2}$$
$$= 61.18823416$$

$$i = 1/2\sqrt{4(R_{2-3})^2 - (h)^2}$$
$$= 1/2\sqrt{(4)\ (139) - (61)^2}$$
$$= 135.3639331$$

$$\theta_2 = 2 \text{ arc sin}\left[\frac{h}{(2)\ (R_{2-3})}\right]$$
$$= 2 \text{ arc sin}\left[\frac{61}{(2)\ (139)}\right]$$

$\theta_2$ = 0.4455837706 radians

$$S_2 = (R_{2-3})\ (\theta_2) = (139)\ (0.445)$$
$$= 61.69501066$$

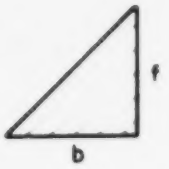
Area B = 139.622 sq in.

= 0.970 sq ft

$$\text{Area B} = 1/2\ [(R_{2-3})\ (S_2) - (h)\ (i)]$$

$$= 1/2\ [(139)\ (62) - (61)\ (135)]$$
$$= 139.6218666$$

Area C:



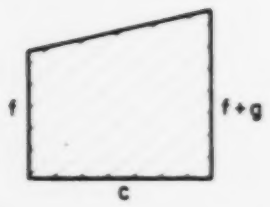

b = 60
f = 42

$$\text{Area C} = 1/2\ (b)\ (f) = 1/2\ (60)\ (42)$$
$$= 1,260$$

Area C = 1,260 sq in.

= 8.75 sq ft

Area D:




c = 60
f = 42
f+g = 54

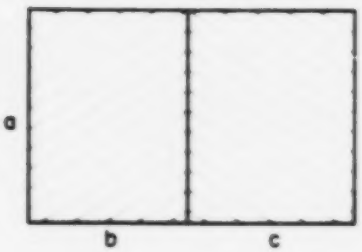
Area D = 1/2 [(f) + (f + g)] c
= 1/2 [42 + 54] 60

= 2,880

Area D = 2,880 sq in.

= 20 sq ft

Area E and F:




a = 84
b = 60
c = 60

Area E and F = (a) (b + c) = (84) (120)
= 10,080

Area E and F = 10,080 sq in.

= 70 sq ft

Area of Kiln End:

Total Area = ( A + B + C + D + E + F) x 2

= 233.576 + 139.622 + 1,260
+ 2,280 + 10,080

= 14,693.198 sq in.

= (101.342 sq ft) x 2

= 202.683 sq ft

Volume of kiln: Volume = (area) x (length)

= (202.683) (32)

= 6,485.866 cu ft (183.659 cu m)

As one cord of wood is 4 ft x 4 ft x 8 ft, the volume of one cord of wood is 128 cu ft (3.625 cu m). Thus, the volume of the kiln is approximately 50.67 cords.

Allowing for air space left along the walls and roof and provided along the floor, the total amount of wood in the kiln would be approximately 45 cords.

APPENDIX G

PRELIMINARY RUNS - FIELD DATA

TABLE G-1

PRELIMINARY DATA AND CALCULATED VALUES

RUN- 1-P DATE- 09-29-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 70.0 | 29.15 | 0.00 | 42.9 | . | . | .20 | 548.70 | 3.0 | 13.0 | 3.5 | .850 |

| PORT- PUINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 549.86 | .004 | .135 | 69.0 | 70.0 | 2.0 | 190.0 | | .597 | 250.0 |
| 1 | 1 | 5.00 | 551.02 | .004 | .135 | 70.0 | 70.0 | 2.0 | 190.0 | | .597 | 250.0 |
| 1 | 1 | 5.00 | 552.17 | .004 | .135 | 75.0 | 70.0 | 2.0 | 240.0 | | .597 | 250.0 |
| 1 | 1 | 5.00 | 553.34 | .004 | .135 | 79.0 | 72.0 | 2.0 | 200.0 | 60.0 | .597 | 250.0 |
| 1 | 1 | 5.00 | 554.60 | .004 | .135 | 81.0 | 74.0 | 2.0 | 200.0 | | .597 | 250.0 |
| 1 | 1 | 5.00 | 556.56 | .004 | .200 | 83.0 | 75.0 | 2.5 | 200.0 | | .597 | 250.0 |

TABLE G-2

PRELIMINARY DATA AND CALCULATED VALUES

RUN- 2-P DATE- 09-29-76

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 78.0 | 29.12 | 0.00 | 35.0 | . | . | .20 | 556.56 | 3.0 | 13.0 | 3.5 | .850 |

| PORT- POINT | | SAMP TIME (MIN | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 557.24 | .004 | .170 | 75.0 | 76.0 | 2.0 | 230.0 | | .594 | 250.0 |
| 1 | 1 | 5.00 | 558.61 | .004 | .210 | 78.0 | 77.0 | 2.0 | 230.0 | | .594 | 250.0 |
| 1 | 1 | 5.00 | 560.03 | .004 | .210 | 84.0 | 78.0 | 2.0 | 200.0 | | .594 | 250.0 |
| 1 | 1 | 5.00 | 561.40 | .004 | .200 | 87.0 | 80.0 | 2.0 | 200.0 | 75.0 | .594 | 250.0 |
| 1 | 1 | 5.00 | 562.70 | .004 | .170 | 89.0 | 81.0 | 2.0 | 200.0 | | .594 | 250.0 |
| 1 | 1 | 5.00 | 563.95 | .004 | .170 | 90.0 | 82.0 | 2.0 | 290.0 | | .594 | 250.0 |

TABLE C-1

PRELIMINARY DATA AND CALCULATED VALUES

RUN- 3-P DATE- 11-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65.0 | 29.38 | 0.00 | 47.0 | . | . | .20 | 232.39 | .5 | 20.0 | 4.7 | .850 |

| PORT- | POINT | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 233.70 | .003 | .170 | 68.0 | 67.0 | 2.5 | 220.0 | 50.0 | .592 | 230.0 |
| 1 | 1 | 5.00 | 234.59 | .003 | .170 | 71.0 | 68.0 | 3.0 | 200.0 | | .592 | 220.0 |
| 1 | 1 | 5.00 | 235.12 | .003 | .170 | 73.0 | 68.0 | 5.0 | 200.0 | | .592 | 220.0 |
| 1 | 1 | 5.00 | 236.27 | .003 | .170 | 75.0 | 70.0 | 5.0 | 200.0 | | .592 | 220.0 |
| 1 | 1 | 5.00 | 237.36 | .003 | .170 | 78.0 | 71.0 | 5.5 | 200.0 | | .592 | 220.0 |
| 1 | 1 | 5.00 | 238.26 | .003 | .170 | 80.0 | 72.0 | 5.5 | 200.0 | | .592 | 220.0 |

TABLE G-4

PRELIMINARY DATA AND CALCULATED VALUES

RUN- 4-P DATE- 11-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 75.0 | 29.34 | 0.00 | 46.5 | [illegible] | [illegible] | .20 | 238.26 | .5 | 20.0 | 4.7 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 239.33 | .003 | .050 | 77.0 | 76.0 | 2.0 | 250.0 | | .613 | 220.0 |
| 1 | 1 | 5.00 | 240.29 | .003 | .050 | 78.0 | 77.0 | 2.0 | 245.0 | 60.0 | .613 | 220.0 |
| 1 | 1 | 5.00 | 241.03 | .003 | .050 | 79.0 | 77.0 | 2.0 | 245.0 | | .613 | 220.0 |
| 1 | 1 | 5.00 | 241.63 | .003 | .050 | 80.0 | 77.0 | 2.0 | 245.0 | | .613 | 220.0 |
| 1 | 1 | 5.00 | 242.30 | .003 | .050 | 82.0 | 78.0 | 3.0 | 245.0 | | .613 | 220.0 |
| 1 | 1 | 5.00 | 243.20 | .003 | .050 | 84.0 | 79.0 | 5.0 | 245.0 | | .613 | 220.0 |

TABLE G-3

PRELIMINARY DATA AND CALCULATED VALUES

RUN- S-P DATE- 11-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 75.0 | 29.34 | 0.00 | 86.5 | [illegible] | [illegible] | .20 | 243.20 | .5 | 20.0 | 4.7 | .850 |

| PORT- POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 244.31 | .002 | .130 | 82.0 | 81.0 | 2.0 | 245.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 245.36 | .002 | .120 | 82.0 | 82.0 | 2.5 | 270.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 246.33 | .002 | .120 | 82.0 | 82.0 | 3.0 | 270.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 247.40 | .002 | .120 | 84.0 | 82.0 | 5.0 | 270.0 | 65.0 | .613 | 200.0 |
| 1 | 1 | 5.00 | 248.49 | .002 | .170 | 84.0 | 82.0 | 7.0 | 270.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 249.55 | .002 | .150 | 84.0 | 82.0 | 8.0 | 270.0 | | .613 | 200.0 |

TABLE G-5

PRELIMINARY DATA AND CALCULATED VALUES

RUN- 6-P DATE- 11-04-75

| ATMOS TEMP (DG.F) | ATMOS PRES (I.HG) | STACK VAC (I.H2O) | H2O COND (ML) | PARTIC WT-PTL (MG) | PARTIC WT-TTL (MG) | STACK AREA (FT2) | INIT VOL (DCF) | PERC O2 DRY | PERC CO2 DRY | PERC CO DRY | PITOT TUBE COEF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 75.0 | 29.35 | 0.00 | 64.0 | . | . | .20 | 249.55 | .5 | 20.0 | 4.7 | .850 |

| PORT-POINT | | SAMP TIME (MIN) | METER VOL (DCF) | DELTA P (I.H2O) | DELTA H (I.H2O) | TEMP IN (D.F) | TEMP OUT (D.F) | TRAIN VAC (I.HG) | STACK TEMP (D.F) | S.GEL TEMP (D.F) | PROBE T DIA (IN) | VEL (FPM) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.00 | 250.50 | .002 | .130 | 78.0 | 78.0 | 7.5 | 270.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 251.35 | .002 | .130 | 78.0 | 78.0 | 8.0 | 280.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 252.50 | .002 | .150 | 78.0 | 79.0 | 7.5 | 280.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 253.70 | .002 | .170 | 80.0 | 79.0 | 6.0 | 280.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 254.74 | .002 | .150 | 83.0 | 80.0 | 6.5 | 280.0 | | .613 | 200.0 |
| 1 | 1 | 5.00 | 255.75 | .002 | .150 | 86.0 | 80.0 | 6.5 | 280.0 | | .613 | 200.0 |

TABLE G-7

PRELIMINARY EMISSION DATA

| NAME | DESCRIPTION | UNITS | 1-P | 2-P | 3-P |
|---|---|---|---|---|---|
| | DATE OF RUN | | 09-29-75 | 09-29-76 | 11-04-75 |
| DN | PROBE TIP DIAMETER | IN | .597 | .594 | .592 |
| TT | NET TIME OF RUN | MIN | 30.0 | 30.0 | 30.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.15 | 29.12 | 29.38 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .146 | .188 | .170 |
| VM | VOL DRY GAS-METER COND | DCF | 7.86 | 7.39 | 5.87 |
| TM | AVG GAS METER TEMP | DEG.F | 74.0 | 81.4 | 71.8 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 7.60 | 7.04 | 5.75 |
| VW | TOTAL H2O COLLECTED | ML | 42.9 | 35.0 | 47.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 2.03 | 1.66 | 2.23 |
| PMOS | PERCENT MOISTURE BY VOL | | 21.1 | 19.1 | 27.9 |
| MD | MOLE FRACTION DRY GAS | | .789 | .809 | .721 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 13.0 | 13.0 | 20.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | 3.0 | 3.0 | .5 |
| PCO | PERCENT CO BY VOL, DRY | | 3.5 | 3.5 | 4.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 80.5 | 80.5 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.20 | 30.20 | 31.22 |
| MW | MOLECULAR WT-STK GAS | | 27.63 | 27.87 | 27.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .004 | .004 | .003 |
| TS | AVG STACK TEMPERATURE | DEG.F | 203.3 | 225.0 | 203.3 |
| NP | NET SAMPLING POINTS | | 6 | 6 | 6 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.15 | 29.12 | 29.38 |
| VS | AVG STACK GAS VELOCITY | FPM | 250 | 250 | 222 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 31 | 30 | 25 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 50 | 50 | 44 |
| PERI | PERCENT ISOKINETIC | | 84.6 | 79.8 | 79.7 |
| EA | PERCENT EXCESS AIR | | 6 | 6 | -9 |

TABLE G-7 (Concluded)

| NAME | DESCRIPTION | UNITS | 4-P | 5-P | 6-P |
|---|---|---|---|---|---|
| | DATE OF RUN | | 11-04-75 | 11-04-75 | 11-04-75 |
| DN | PROBE TIP DIAMETER | IN | .613 | .613 | .613 |
| TT | NET TIME OF RUN | MIN | 30.0 | 30.0 | 30.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.34 | 29.34 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .050 | .135 | .147 |
| VM | VOL DRY GAS-METER COND | DCF | 4.94 | 6.35 | 6.20 |
| TM | AVG GAS METER TEMP | DEG.F | 78.7 | 82.4 | 79.8 |
| VMSTD | VOL DRY GAS-STD COND | DSCF | 4.77 | 6.09 | 5.97 |
| VW | TOTAL H2O COLLECTED | ML | 46.5 | 86.5 | 64.0 |
| VWV | VOL H2O VAPOR-STD COND | SCF | 2.20 | 4.10 | 3.03 |
| PMOS | PERCENT MOISTURE BY VOL | | 31.6 | 40.3 | 33.7 |
| MD | MOLE FRACTION DRY GAS | | .684 | .597 | .663 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 20.0 | 20.0 | 20.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | .5 | .5 | .5 |
| PCO | PERCENT CO BY VOL, DRY | | 4.7 | 4.7 | 4.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 74.8 | 74.8 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.22 | 31.22 | 31.22 |
| MW | MOLECULAR WT-STK GAS | | 27.04 | 25.90 | 26.77 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .003 | .002 | .002 |
| TS | AVG STACK TEMPERATURE | DEG.F | 245.8 | 265.8 | 278.3 |
| NP | NET SAMPLING POINTS | | 6 | 6 | 6 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.34 | 29.34 | 29.35 |
| VS | AVG STACK GAS VELOCITY | FPM | 220 | 200 | 200 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QS | STK FLOWRATE, DRY,STD CN | DSCFM | 22 | 17 | 19 |
| QA | ACTUAL STACK FLOWRATE | ACFM | 44 | 40 | 40 |
| PERI | PERCENT ISOKINETIC | | 69.8 | 115.3 | 103.7 |
| EA | PERCENT EXCESS AIR | | -9 | -9 | -9 |

TABLE G-8

PRELIMINARY EMISSION DATA (METRIC RESULTS)

| NAME | DESCRIPTION | UNITS | 1-P | 2-P | 3-P |
|---|---|---|---|---|---|
| | DATE OF RUN | | 09-29-75 | 09-29-76 | 11-04-75 |
| DN | PROBE TIP DIAMETER | IN | .597 | .594 | .592 |
| TT | NET TIME OF RUN | MIN | 30.0 | 30.0 | 30.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.15 | 29.12 | 29.38 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .146 | .188 | .170 |
| VM | VOL DRY GAS-METER COND | DCF | 7.86 | 7.39 | 5.87 |
| TM | AVG GAS METER TEMP | DEG.F | 74.0 | 81.4 | 71.8 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .22 | .20 | .16 |
| VW | TOTAL H2O COLLECTED | ML | 42.9 | 35.0 | 47.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .06 | .05 | .06 |
| PMOS | PERCENT MOISTURE BY VOL | | 21.1 | 19.1 | 27.9 |
| MD | MOLE FRACTION DRY GAS | | .789 | .809 | .721 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 13.0 | 13.0 | 20.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | 3.0 | 3.0 | .5 |
| PCO | PERCENT CO BY VOL, DRY | | 3.5 | 3.5 | 4.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 80.5 | 80.5 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 30.20 | 30.20 | 31.22 |
| MW | MOLECULAR WT-STK GAS | | 27.63 | 27.87 | 27.53 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .004 | .004 | .003 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 95.2 | 107.2 | 95.2 |
| NP | NET SAMPLING POINTS | | 6 | 6 | 6 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.15 | 29.12 | 29.38 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 76.2 | 76.2 | 67.6 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .9 | .9 | .7 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.4 | 1.4 | 1.3 |
| PERI | PERCENT ISOKINETIC | | 84.6 | 79.8 | 79.7 |
| EA | PERCENT EXCESS AIR | | 6 | 6 | -9 |

TABLE G-8 (Concluded)

| NAME | DESCRIPTION | UNITS | 4-P | 5-P | 6-P |
|---|---|---|---|---|---|
| | DATE OF RUN | | 11-04-75 | 11-04-75 | 11-04-75 |
| DN | PROBE TIP DIAMETER | IN | .613 | .613 | .613 |
| TT | NET TIME OF RUN | MIN | 30.0 | 30.0 | 30.0 |
| PB | BAROMETRIC PRESSURE | IN.HG | 29.34 | 29.34 | 29.35 |
| PM | AVG ORIFICE PRES DROP | IN.H2O | .050 | .135 | .147 |
| VM | VOL DRY GAS-METER COND | DCF | 4.94 | 6.35 | 6.20 |
| TM | AVG GAS METER TEMP | DEG.F | 78.7 | 82.4 | 79.8 |
| VMSTM | VOL DRY GAS-STD COND | NCM | .13 | .17 | .17 |
| VW | TOTAL H2O COLLECTED | ML | 46.5 | 86.5 | 64.0 |
| VWM | VOL H2O VAPOR-STD COND | NM3 | .06 | .12 | .09 |
| PMOS | PERCENT MOISTURE BY VOL | | 31.6 | 40.3 | 33.7 |
| MD | MOLE FRACTION DRY GAS | | .684 | .597 | .663 |
| PCO2 | PERCENT CO2 BY VOL, DRY | | 20.0 | 20.0 | 20.0 |
| PO2 | PERCENT O2 BY VOL, DRY | | .5 | .5 | .5 |
| PCO | PERCENT CO BY VOL, DRY | | 4.7 | 4.7 | 4.7 |
| PN2 | PERCENT N2 BY VOL, DRY | | 74.8 | 74.8 | 74.8 |
| MWD | MOLECULAR WT-DRY STK GAS | | 31.22 | 31.22 | 31.22 |
| MW | MOLECULAR WT-STK GAS | | 27.04 | 25.90 | 26.77 |
| CP | PITOT TUBE COEFFICIENT | | .850 | .850 | .850 |
| DPS | AVG STK VELOCITY HEAD | IN.H2O | .003 | .002 | .002 |
| TSM | AVG STACK TEMPERATURE | DEG.C | 118.8 | 129.9 | 136.8 |
| NP | NET SAMPLING POINTS | | 6 | 6 | 6 |
| PST | STATIC PRES OF STACK | IN.HG | -0.00 | -0.00 | -0.00 |
| PS | STACK PRESSURE, ABSOLUTE | IN.HG | 29.34 | 29.34 | 29.35 |
| VSM | AVG STACK GAS VELOCITY | M/MIN | 67.1 | 61.0 | 61.0 |
| AS | STACK AREA | IN2 | 29 | 29 | 29 |
| QSM | STK FLOWRATE, DRY,STD CN | NM3/MIN | .6 | .5 | .5 |
| QAM | ACTUAL STACK FLOWRATE | M3/MIN | 1.2 | 1.1 | 1.1 |
| PERI | PERCENT ISOKINETIC | | 69.8 | 115.3 | 103.7 |
| EA | PERCENT EXCESS AIR | | -9 | -9 | -9 |

APPENDIX H

COMPUTATION FOR ISOKINETIC SAMPLING

$$PERI = \frac{(1,032)\ (TS + 460)\ (VMSTD)}{(VS)\ (TT)\ (PS)\ (MD)\ (DN)^2} \quad \underline{a}/$$

$$VMSTD = \frac{(17.71)\ (VM)\ (PB + \frac{PM}{13.6})}{(TM + 460)} \quad \underline{a}/$$

$$MD = \frac{100 - PMOS}{100} \quad \underline{a}/$$

Where:

PERI = percent isokinetic sampling rate

TS = stack temperature (°F)

VMSTD = volume dry gas sampled, standard conditions (dsct)

VS = stack gas velocity (fpm)

TT = net sampling time (min)

PS = stack pressure, absolute (in. Hg)

MD = mole fraction, dry gas

DN = probe tip diameter (in.)

VM = volume dry gas sampled, meter conditions (dcf)

PB = barometric pressure (in. Hg)

PM = orifice pressure drop (in. $H_2O$)

TM = meter temperature (°F)

PMOS = percent stack gas moisture, by volume

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a/ From Federal Register.1/

$$PERI = \frac{(1{,}032)\ (TS + 460)\ (17.71)\ (VM)\ (PB + \frac{PM}{13.6})}{(VS)\ (TT)\ (PS)\ (MD)\ (DN)^2\ (TM + 460)}$$

$$VM = \frac{(PERI)\ (VS)\ (TT)\ (PS)\ (MD)\ (DN)^2\ (TM + 460)}{(1{,}032)\ (TS + 460)\ (17.71)\ (PB + \frac{PM}{13.6})} \quad \text{as } \frac{PM}{13.6} \ll PB;\ PB \sim PS$$

$$VM = \left[\frac{(PERI)\ (TT)\ (DN)^2}{(1{,}032)\ (17.71)}\right] \left[(MD)\right] \left[\frac{(VS)\ (TM + 460)}{(TS + 460)}\right]$$

Known for given test:

PERI = 100

TT = 5

DN

Known for given day:

MD (based on preliminary or previous day)

Known for each stack:

VS

Known for each 5-min sampling period:

TM

TS

Thus for each incremental sampling period, a volume to be sampled can be determined, approximating isokinetic sampling for each period, stack, and run.

APPENDIX I

TABLE OF METRIC EQUIVALENTS

| To convert from | To | Multiply by |
|---|---|---|
| inch (in.) | centimeter (cm) | 2.540 E-00 |
| foot (ft) | meter (m) | 3.048 E-01 |
| square inches (sq in.) | square meters (sq m) | 6.542 E-04 |
| square feet (sq ft) | square meters (sq m) | 9.290 E-02 |
| cubic inches (cu in.) | cubic meters (cu m) | 1.639 E-05 |
| cubic feet (cu ft) | cubic meters (cu m) | 2.832 E-02 |
| pounds (lb) | kilograms (kg) | 4.536 E-01 |
| pounds per cubic foot (pcf) | kilograms per cubic meter (kg/ cu m) | 1.602 E+01 |
| degrees Fahrenheit (°F) | degrees Celsious (°C) | $t_C = \frac{t_F - 32}{1.8}$ |
| British thermal units (Btu) | calories (cal) | 2.52 E+02 |
| calories per gram per degrees centigrade (cal/g/°C) | joules per gram per degrees centigrade (joules/g/°C) | 4.185 E-00 |